FURUNO

INSTALLATION MANUAL

MARINE RADAR

MODEL FR-1505/1510/1525 MARK-2

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

©FURUNO ELECTRIC CO., LTD.

9-52, Ashihara-cho,
Nishinomiya, Japan 662

Telephone: 0798-65-2111
Telefax: 0798-65-4200

·Your Local Agent/Dealer

FIRST EDITION : OCT 1994
H : AUG. 19, 1997

 Printed in Japan

PUB. No. IME-33960-H
(TATA) FR-1500 MARK-2 SER.

000806279 00

⚠ SAFETY INSTRUCTION

"**NOTIICE**", "**CAUTION**" and "**WARNING**" notices appear throughout this manual. It is the responsibility of the installer of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.

⚠ WARNING	This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION	This notice indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury or property damage.

NOTICE	This notice indicates an unsafe practice which, if not avoided, could result in property damage or equipment malfunction.

⚠ WARNING



Hazardous voltage.
Can shock, burn, or cause death.

Only qualified personnel should work in the unit.

Turn off the power at the ship's mains switchboard before beginning the installation. Post a warning sign near the switchboard to ensure the power will not be applied while the radar system is being installed.

Electrical shock, fire, serious injury or death can result if the power is not turned off, or is applied while the equipment is being installed.



Turn off the radar power switch before working on the antenna unit. Post a warning sign near the switch to ensure it will not be turned on while the antenna unit is being installed.

Serious injury or death can result if the radiator starts rotating and strikes someone near the scanner unit.



Wear a safety belt and hard hat when working on the antenna unit.

Serious injury or death can result if someone falls from the scanner mast.

⚠ WARNING



Radio Frequency Radiation Hazard

The radar antenna emits electromagnetic radio frequency (RF) energy which can be harmful, particularly to your eyes. Never look directly into the antenna aperture from a close distance while the radar is in operation or expose yourself to the transmitting antenna at a close distance.

Distances at which RF radiation levels of 100 and 10 W/m exist are;

Model	Radiation level	XN2	XN3	XN3A	XN4A
FR-1505 M2	10W/m	Nowhere			
	1W/m	5m	4m	4m	4m
FR-1510 M2	10W/m	0.5m	—	—	—
	1W/m	9m	9m	9m	9m
FR-1525 M2	10W/m	4m	3m	3m	3m
	1W/m	15m	15m	15m	15m

NOTE: *When the antenna is installed at a close distance in front of the wheelhouse, transmission can be stopped within a certain sector of revolution.*

⚠ CAUTION

Ground both the display unit and the antenna unit.

Ungrounded equipment can give off or receive interference or cause electrical shock.

Confirm that the power supply voltage is compatible with the voltage rating of the equipment.

Connection to the wrong power supply can cause fire or equipment damage. The voltage rating appears on the label at the rear of the display unit.

Use only the supplied power cable.

Use of other power cables (particularly cables whose diameter is smaller than the supplied cable) can cause fire or short circuit.

Use the correct fuse.

Use of a wrong fuse can cause fire or equipment damage.

NOTICE

The installation must be done by a FURUNO representative or suitably qualified radar technician.

Authorities require this.

The mounting location must satisfy the following conditions:

- Useable temperature: -15°C to 55°C
- Out of direct sunlight
- Away from air conditioner vents
- Well ventilated

Observe the compass safe distances to prevent deviation of a magnetic compass.

	Standard compass	Steering compass
Display Unit	1.7 m	1.10 m
Scanner Unit	1.50 (3.4) m	0.90 (2.2) m

( ) : 1525M2

Keep magnets and magnetic fields away from the equipment.

Magnetic fields will distort the picture and can cause equipment malfunction. Be sure the unit is well away from equipment which gives off magnetic fields (speaker, power transformer, etc.).

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INSTALLATION OF GC-8A (option) 18

OUTLINE DRAWINGS D-1

SCHEMATIC DIGRAMS S-1

EQUIPMENT LISTS

Complete Set

Name			Type	Code No.	Qty	Remarks
SCANNER UNIT	FR-1505 MARK-2	24 rpm	XN2-C2P7N2N-043-S		1	123 cm radiator
			XN3-C2P7N2N-043-S			200 cm radiator
			XN3A-C2P7N2N-043			200 cm radiator
		36 rpm	XN2-RSB0063-043-S			123 cm radiator
			XN3-RSB0063-043-S			200 cm radiator
			XN3A-RSB0063-043-S			200 cm radiator
	FR-1510 MARK-2	24 rpm	XN2-C2P7N2N-044-S		1	123 cm radiator
			XN3-C2P7N2N-044-S			200 cm radiator
			XN3A-C2P7N2N-044-S			200 cm radiator
			XN4A-C2P7N2N-044-S			240 cm radiator
		36 rpm	XN2-RSB0063-044-S			123 cm radiator
			XN3-RSB0063-044-S			200 cm radiator
			XN3A-RSB0063-044-S			200 cm radiator
			XN4A-RSB0063-044-S			240 cm radiator
	FR-1525 MARK-2	24 rpm	XN2-RSB0014-045-S		1	123 cm radiator
			XN3-RSB0014-045-S			200 cm radiator
			XN3A-RSB0014-045-S			200 cm radiator
			XN4A-RSB0014-045-S			240 cm radiator
		36 rpm	XN2-RSB0064-045-S			123 cm radiator
			XN3-RSB0064-045-S			200 cm radiator
			XN3A-RSB0064-045-S			200 cm radiator
			XN4A-RSB0064-045-S			240 cm radiator
Signal Cable Assy. (Selectable)			S03-53-X		1	15m, 20m, 25m, or 30m
			ML connector Assy.	008-461-500		For HV line
Display Unit	FR-1505 MARK-2		RDP-111-A		1	
	FR-1510 MARK-2		RDP-111-B		1	
	FR-1525 MARK-2		RDP-111-C		1	
Installation Materials			CP03-14201 (display)	008-455-250	1 set	See respective installation materials list.
			CP03-00820 (scanner)	008-215-990	1 set	
Accessories			FP03-05600	008-102-930	1 set	Hood assy.
Spare Parts			SP03-11100	000-085-937	1 set	For display unit
			SP03-11102	000-455-240	1 set	For scanner unit
			SP03-09000	000-419-080	1 set	For GC-8A

Optional Supply & Equipment to be Connected

Name	Type	Code No.	Remarks
Auto Plotter	ARP-15	008-455-710	
Video Plotter	RP-15		
Gyro Converter	GC-8A	008-461-560	
Signal Cable	S03-55-5	008-455-160	5pin XH, factory wired 5 m
Interswitch	RJ-2	000-030-062	
Rectifier	RU 1746B-2	000-030-439	110 VAC
		000-430-440	220 VAC
Power Cable	CVV-S 8 x 2C, 15 m	000-560-634	
Color Display	CD-140/141		
Video Plotter	GD-500/500 M2		
Remote Display	FMD-8000(LOG)/8010		
External Buzzer	OP03-21	000-030-097	
Handgrip	OP03-70	008-423-420	
Filter	OP03-30	008-102-200	
Dust Cover	03-024-0401	000-801-325	

Accessories

Name	Type	Code No.	Qty	Remarks
Hood Assy.	FP03-02310	008-102-930	1	

Spare Parts for Display Unit

Name	Type	Code No.	Qty	Remarks
Fuse	FGBO-A 3A 125VAC	000-549-063	2	For CRT
Fuse	FGBO 10A 125VAC	000-549-065	2	For 24/32VDC
Fuse	FGBO 20A 125VAC	000-549-015	2	For 12VDC

Spare Parts for Scanner Unit

Name	Type	Code No.	Qty	Remarks
Carbon Brush	MG120-5 x 6 x 11D8G	000-631-716	2	

Installation Materials for Display Unit

Name	Type	Code No.	Qty	Remarks
Signal cable assy 15m	S03-53-15	008-455-070	1	Select one. Connector at one end, no armor, ø18.4. (standard length: 15m)
Signal cable assy 20m	S03-53-20	008-455-080		
Signal cable assy 25m	S03-53-25	008-455-090		
Signal cable assy 30m	S03-53-30	008-455-100		
Crimp-on lug	FV2-4	000-538-118	4	For power cable
	8NK4	000-538-180	6	
Panhead Screw	M3 x 10 C2700W MBN12	000-881-105	2	For fixing DJ conn. of display unit
XH Connector Assy.	03-1768(3P)	008-459-090	1	For connection of log
XH Connector Assy.	03-1798(4P)	008-463-400	1	For connection of radar buoy
XH Connector Assy.	03-1796(5P)	008-462-830	4	NAV I/O, E/S, AD-100

Installation Materials for Scanner Unit

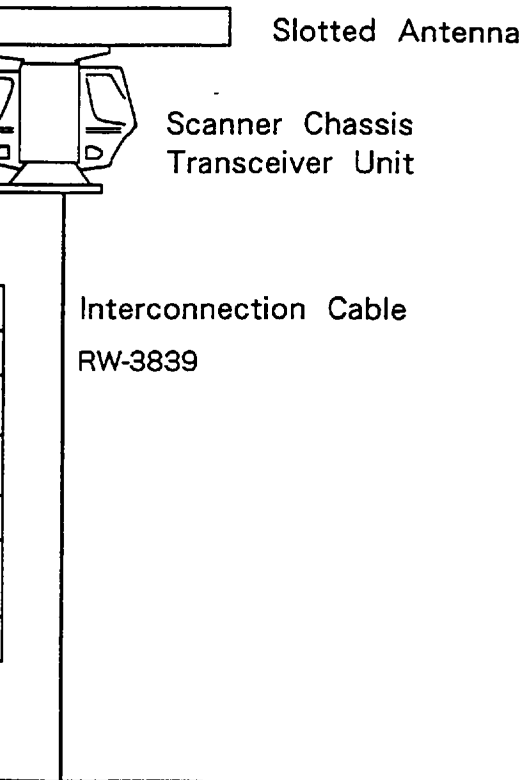
Name	Type	Code No.	Qty	Remarks
Grounding Wire	RW-4747 1 = 320 mm	000-566-000	1	For grounding scanner
Hex Bolt	M6 x 25 SUS304	000-862-180	1	For mounting grounding wire
	M12 x 60 SUS304	000-862-191	4	For mounting scanner
Hex Nut	M6 SUS304	000-863-109	1	For mounting grounding wire
	M12 SUS304	000-863-112	4	For mounting scanner
Flat Washer	M6 SUS304	000-864-129	3	For mounting grounding wire
	M12 SUS304	000-863-132	4	For mounting scanner
Spring Washer	M6 SUS304	000-864-260	1	For mounting grounding wire
	M12 SUS304	000-864-263	4	For mounting scanner
Crimp-on Lug	FVD1.25-3, red	000-116-634	1	For coaxial cable (2C-2V)
	FV1.25-L3, red	000-538-111	29	For scanner terminal board
	FV2-4, blue	000-538-118	1	For scanner terminal board
	8NK4	000-538-180	2	For connecting DC power
Corrosion-proof Rubber Mat	03-001-3001-0 CR	300-130-010	1	For preventing electrolytic corrosion
Seal Washer	03-001-3002-0	300-130-020	4	For preventing electrolytic corrosion

Cabling for Feeding Data to/from Display Unit

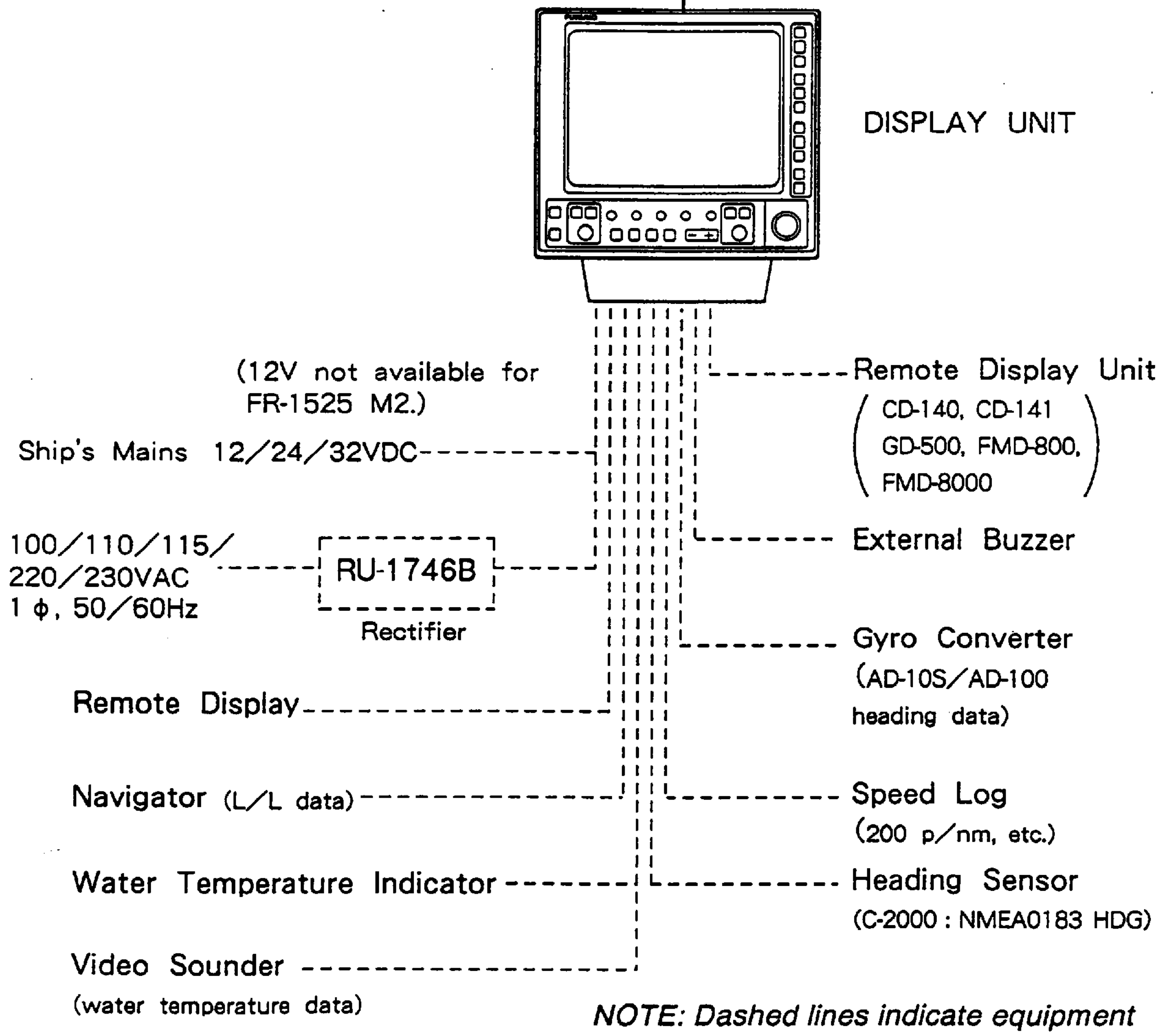
Equipment to Connect	Cable Required	Cable Assy. Type	Cable Assy. Code No.	Remarks
Navigator	CO-SPEVV-SB-C 0.2 x 2P (5P)	S-03-55-5	008-455-160	NMEA data input, 5 pin XH, factory wired
Gyrocompass	250V-MPYC (Y)-5			local supply
AD-10S, AD-100	CO-SPEVV-SB-C 0.2 x 2P (5P)	S-03-55-5	008-455-160	
Speed log	250V-MPYC (Y)-1.25			local supply
Slave display	RW-4865 * 5M *	S03-22-5	008-239-140	Supplied with slave display installation materials
	RW-4865 * 10M *	S03-22-10	008-239-150	
	RW-4865 * 15M *	S03-22-15	008-239-160	
Remote display				supplied with FMD-1800
Water temp, depth, HDG data (NMEA)	CO-SPEVV-SB-C 0.2 X 2P (5P)	S03-55-5	008-455-160	5 pin XH, factory wired

SYSTEM CONFIGURATION

SCANNER UNIT



Unit		FR-1505 M2	FR-1510 M2	FR-1525 M2
Display unit		RDP-111A	RDP-111B	RDP-111C
Scanner chassis (select one)	24rpm	C2P7N2N		RSB-0014
	36rpm	RSB-0063		RSB-0064
Transceiver unit		RTR-043	RTR-044	RTR-045
Slotted antenna (select one)		XN2/3/3A	XN2/3/3A/4A	
Power consumption		120W	135W	160W



NOTE: Dashed lines indicate equipment which can be connected.

MOUNTING OF UNITS

Scanner Unit Installation

Before beginning the installation...

- Wear a helmet and safety belt when working on the mast.
- Secure an "off limits" area to prevent injury due to falling objects.
- DO NOT lift the scanner unit by the radiator. Use the lifting fixtures on the unit.
- DO NOT paint the radiator surface.
- Observe the following compass safe distances to prevent deviation of the magnetic compass;

Table 1 Scanner unit compass safe distances

Compass	FR-1505/1510 M2	FR-1525 M2
Standard	1.50 meters	2.5 meters
Steering	0.90 meters	2.0 meters

- Distances at which radiation level of 10 and 1 W/ m^2 exist are;

Table 2 Radiation levels

Model	Radiation level	XN2	XN3	XN3A	XN4A
FR-1505 M2	$10W/m^2$	Nowhere			
	$1W/m^2$	5m	4m	4m	4m
FR-1510 M2	$10W/m^2$	0.5m	—	—	—
	$1W/m^2$	9m	9m	9m	9m
FR-1525 M2	$10W/m^2$	4m	3m	3m	3m
	$1W/m^2$	15m	15m	15m	15m

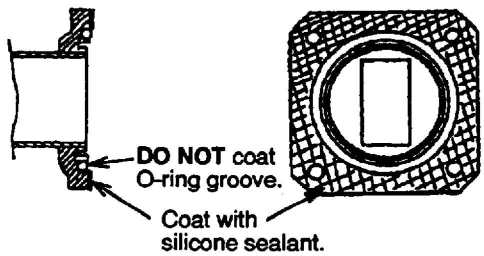
Siting considerations

- The scanner unit is generally installed either on top of the wheelhouse or on the radar mast on an appropriate platform, parallel with ship's keel line. It should be placed where there is a good all-round view with, as far as possible, no part of the ship's superstructure or rigging within the scanner's vertical beamwidth (XN2/3, 25°; XN3A/4A, 20°)
- Five fixing holes are required in the scanner unit platform: Four ø15 mm for mounting of the scanner unit and one ø50 mm for the signal cable.
- If there is a radio direction finder on the vessel, locate its antenna clear of the scanner unit, to prevent interference to the direction finder.
- Deposits and fumes from a funnel or other exhaust vent can adversely affect the aerial performance and hot gases tends to distort the radiator portion. The scanner unit must not be mounted where it may be subjected to temperatures in excess of 70°C.

Assembling

The procedure which follows provides general scanner unit assembly instructions. Assemble the unit by referring to the scanner unit outline drawing at the end of this manual.

1) Coat the waveguide flange with silicone sealant as shown in Figure 1.



Evenly coat the waveguide flange with silicone sealant. Apply just enough so the sealant oozes out when the bolts are tightened. Be sure no sealant contacts the choke groove and waveguide.

Figure 1 How to coat the waveguide flange with silicone sealant

2) Fix the feeder waveguide to the rotary joint.
3) Loosely fasten the antenna radiator to the rotary joint.
4) Fasten the feeder waveguide to the antenna radiator.
5) Fasten the feeder waveguide to the base of the antenna radiator.
6) Fasten the antenna radiator to the antenna bracket.

Mounting

1) Lay the corrosion-proof rubber mat (supplied) on the mounting platform.

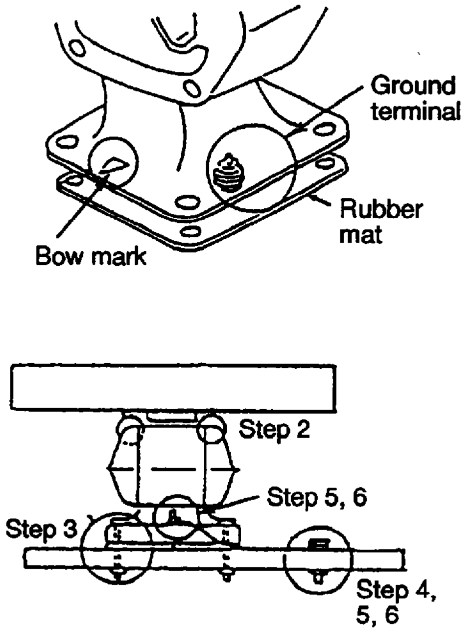


Figure 2 Location of bow mark, steps in mounting the scanner unit

2) Hoist the scanner unit to the mounting location. Orient the scanner unit so the bow mark on the scanner unit faces ship's bow.

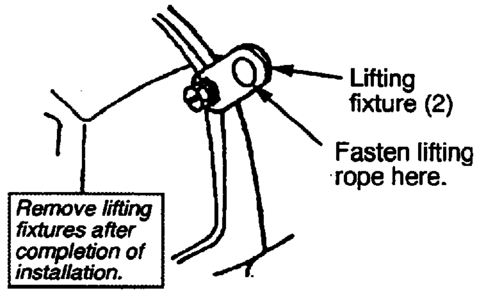


Figure 3 Location of lifting fixtures

3) Fasten the scanner unit to the mounting platform with M12 x 60 hex bolts, seal washers and nuts.

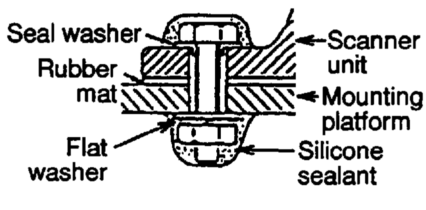


Figure 4 How to fasten scanner unit to mounting platform

4) Prepare ground point in mounting platform (within 300 mm of ground terminal on scanner unit) using M6 x 25 bolt, nut and flat washer.

5) Run the ground wire (RW-4747, 320 mm) between the ground terminal and ground point.

6) Coat ground terminal and ground point with silicone sealant as shown in Figure 5.

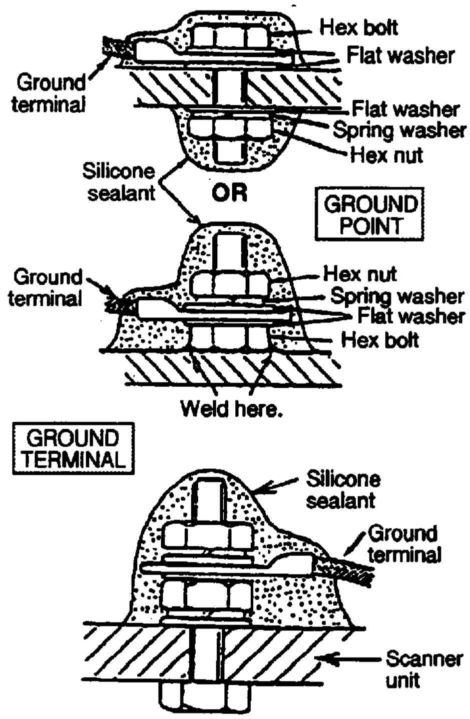


Figure 5 How to coat ground point and ground terminal with silicone sealant

Display Unit Installation

Siting considerations

- The display unit can be mounted on a tabletop, a bulkhead or on the overhead. Install it where it can be viewed and operated conveniently, but where it is protected from being sprayed or immersed in salt or fresh water.
- Observe the following display unit compass safe distances to prevent deviation of the magnetic compass;

Table 3 Display unit compass safe distances

Compass	FR-1505/1510/1525 MARK-2
Standard	1.70 meters
Steering	1.10 meters

- The display unit should be oriented so that you can view the screen while facing towards the bow. This will make determination of your position easier.

- The mounting location must be strong enough to support the display unit under vibration conditions normally encountered on the vessel. If necessary reinforce the mounting location.
- Determine the mounting location considering the distance between the scanner unit and the display unit. (The maximum length of the signal cable is 60 meters.)
- Make sure you allow enough clearance to get to the connectors behind the unit. Leave at least a foot or so of "service loop" in cables so that it can be pulled forward for servicing or easy removal of the connectors.

Tabletop mounting

1) Loosen the two M8 x 40 bolts at the front of the display unit. Remove the fixing plate.
2) Mark screws locations in the tabletop by using the fixing plate as a template. **For mounting by bolts and nuts,** drill four holes of 12 mm diameter in the tabletop.
3) Secure the fixing plate to the tabletop by tapping screws or M10 bolts, nuts and washers.
4) Lay the display unit on the fixing plate. Secure it with the two M8 x 40 bolts loosened in step 1.

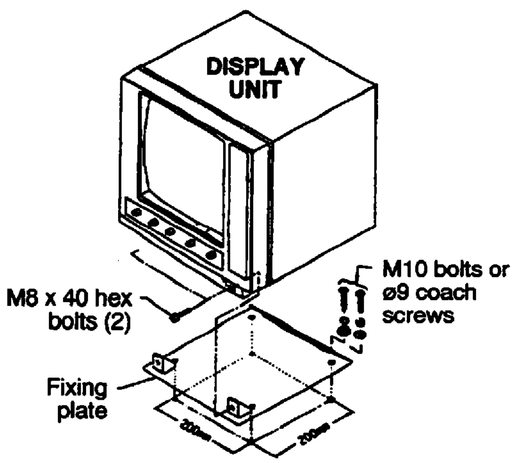


Figure 6 Tabletop mounting

Overhead mounting

1) Referring to Figure 7, change the location of the fixing plate, mounting base, bottom plate and cover to mount the unit on the overhead.

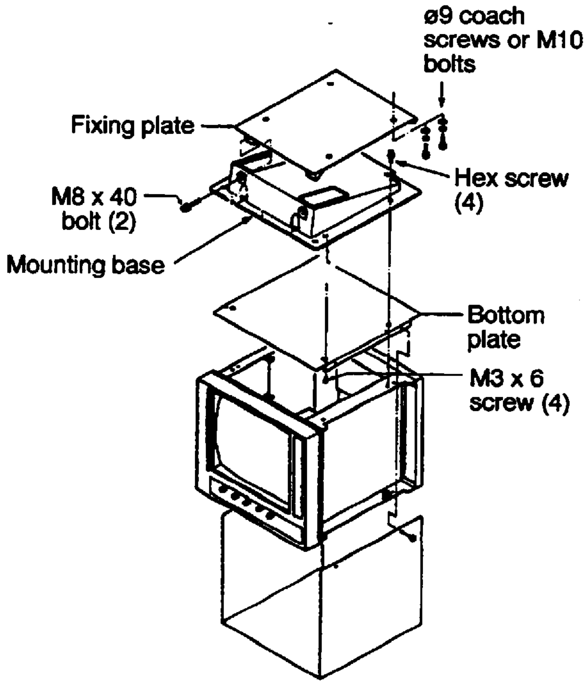


Figure 7 Display unit bulkhead or overhead mounting

Installation of hand grips (option)

Remove black cosmetic caps on both sides of front panel. Fasten hand grips.

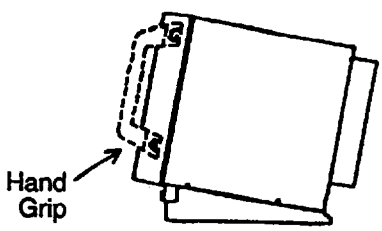


Figure 8 Hand grips

WIRING

Scanner Unit Wiring

Handling the transceiver unit

The transceiver unit contains the magnetron. The magnetron will demagnetize if it contacts magnetic material. When dismounting the transceiver, lay it atop non-magnetic material or lay it on its side, to prevent demagnetization. See Figure 9.

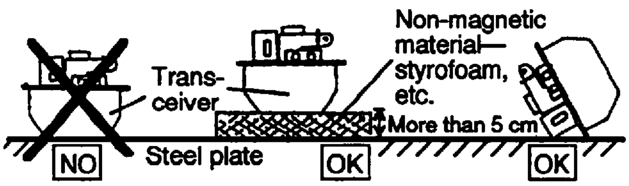


Figure 9 How to set the transceiver to prevent magnetron demagnetization

Wiring

1) Open the scanner unit cover.
2) Disconnect plugs P801 and P601.
3) Unfasten the transceiver unit fixing bolts and dismount the transceiver unit from the scanner unit.

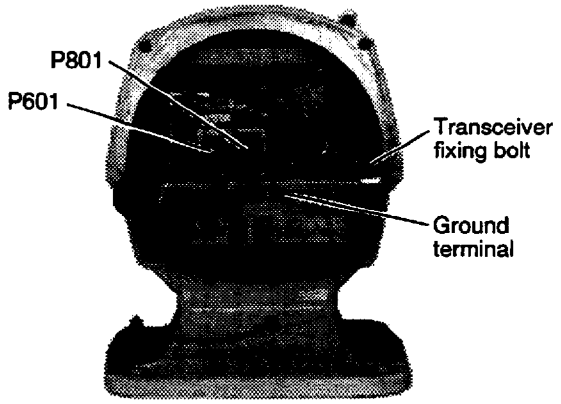


Figure 10 Transceiver unit, front view

4) Unfasten four fixing bolts on the cable gland at the base of the scanner unit. Remove clamping ring, rubber gasket and flat washers (2) from cable gland. See Figure 11.
5) Pass the signal cable through the cable entry hole in the scanner unit mounting platform. Shorten the cable so about 80 cm of it protrudes out of the cable gland.
6) Slide the flat washer, rubber gasket, flat washer and clamping ring onto the cable in that order.

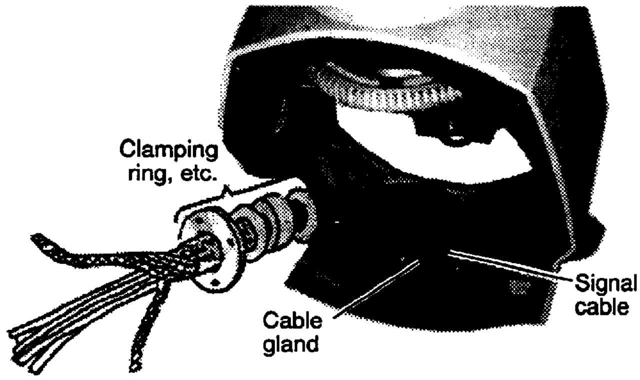


Figure 11 Passing cable gland assembly materials onto signal cable

7) Fabricate the signal cable as shown on page 5. Make the length of the cable a little longer than necessary to prevent damage to the coaxial cable.
8) Pass the outer and inner shields between the signal cable and the clamping ring. Fasten the cable gland.

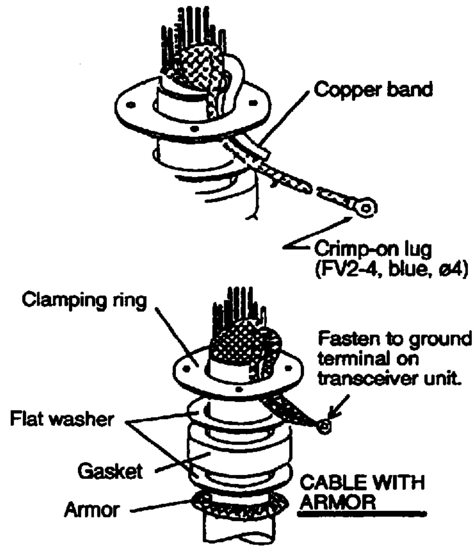


Figure 12 Passing shields between clamping ring and signal cable

9) Connect the signal cable to the terminal board RTB801 by referring to the interconnection diagram.
10) Bind cores with cable ties as shown in Figure 13.

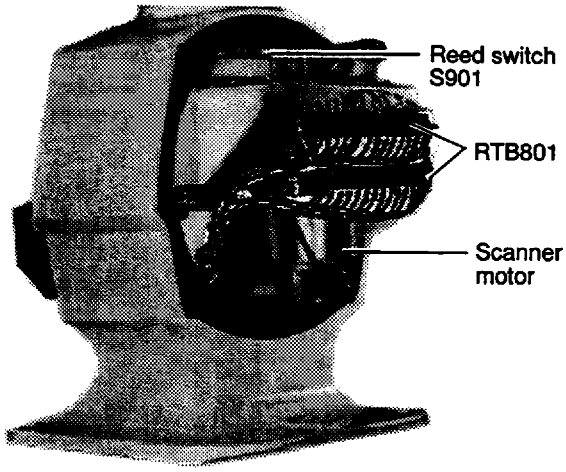


Figure 13 Scanner unit, rear view, cover opened

11) Install the transceiver unit. Connect plugs P801 and P601. Fasten the shields (inner and outer combined) to the ground terminal on the transceiver unit. See Figure 10 for location of ground terminal.

12) If the scanner is mounted leftward of the ship's bow line by up to 2°, turn on reed switch S901. (It is electrically connected to P902 #1 and #2 on the BRG SIG GEN Board MP-3795).

13) Confirm that all screws are tightened and all wiring is properly made.

14) Coat waterproofing gasket, bolts and tapping holes of scanner unit with silicone grease as shown in Figure 14.

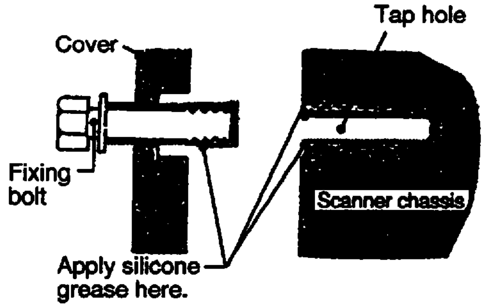


Figure 14 Coating scanner unit cover with silicone grease

15) Confirm that the waterproofing gasket is seated as shown in Figure 15.

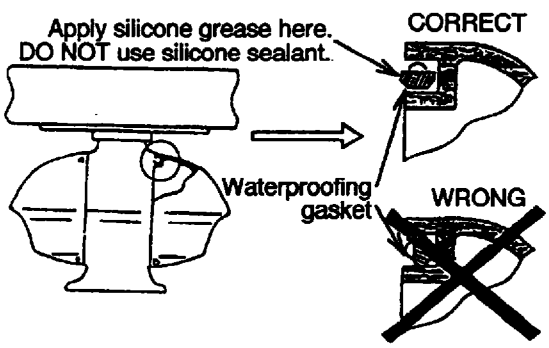


Figure 15 Seating of waterproofing gasket

Fabricating signal cable RW-3839

1) Remove the vinyl sheath by 450 mm.

2) Slide flat washers (2), rubber gasket, washer, and clamping ring onto the cable.

3) Unravel the outer shield to expose the cores in the outer layer.

4) Unravel the inner shield to expose the cores in the inner layer. Label all inner cores to aid in later identification.

5) Trim each core (except coaxial wire) considering the distance to their terminals on the terminal board.

6) Trim the inner and outer shields leaving 50 mm each. Combine shields and attach crimp on-lug FV2-4 (blue, ø4).

7) Remove core insulation by 6 mm approximately. Fix crimp-on lug FV1.25-L3 (red, ø3) to each core.

8) Fabricate the coaxial cable. Make the length 10 mm longer than the shield to prevent wire strain. Attach crimp-on lug FDV1.25-3 (red, ø3).

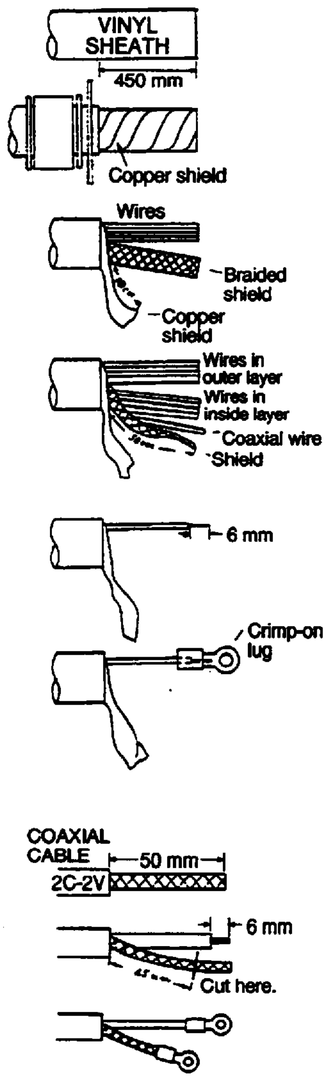


Figure 16 Fabricating signal cable RW-3839

Display Unit Wiring

Overview

At least two cables are terminated at the display unit: the signal cable and the power cable. The signal cable, which is available in lengths of 15 meters, 20 meters, 25 meters or 30 meters, comes prefitted with a connector for connection to the display unit.

Proper grounding of cables cannot be stressed enough; be sure to ground the shield of cables by the cable clamp.

Fabricating the power cable CVV-S 8 x 2C (optional supply)

1) Remove the vinyl sheath by 40 mm.
2) Unravel the braided shield to expose the cores.
3) Remove insulation of cores by about 10 mm.
4) Fix crimp-on lugs to the cores and braided shield.

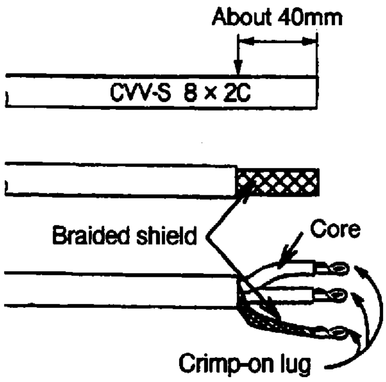


Figure 17 How to fabricate the power cable (CVV-S 8 x 2C)

Wiring procedure

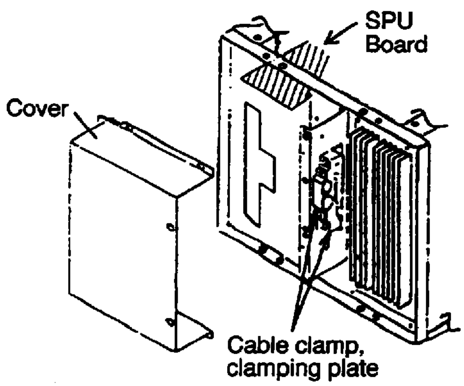


Figure 18 Display unit, rear view, cover removed

1) Remove the display unit cover.
2) Dismount the clamping plate from the cable clamp by loosening two screws.
3) Lay the signal cable and power cable inside the cable clamp. Fasten the clamping plate to the cable clamp by using two M4 x 12 screws. If optional equipment are connected, secure the clamping plate by using two M6 x 30 bolts.

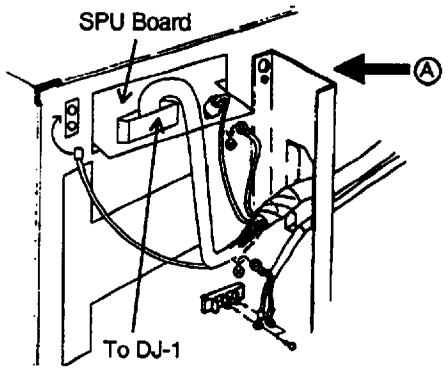


Figure 19 Display unit, rear view

4) Connect the power cable and signal cable by referring to the interconnection diagram. Fasten shields to chassis.
5) Run a ground wire (IV-8 sq, or equivalent) from the ground terminal to nearest ground point.

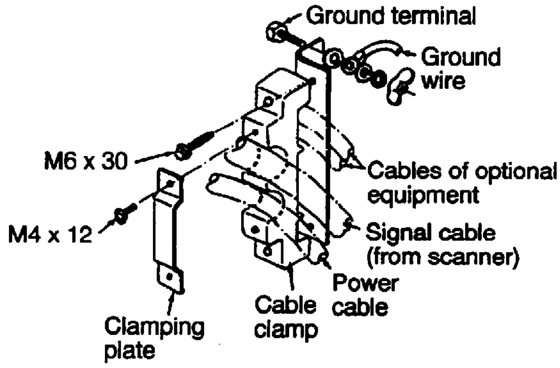


Figure 20 Exploded view of Ⓐ in Figure 19

It is recommended to seal the cable gland (with aluminum tape, etc.) to keep foreign objects out of the display unit.

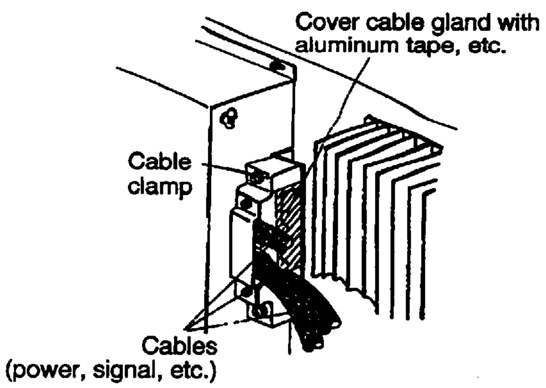


Figure 21 Sealing the cable gland

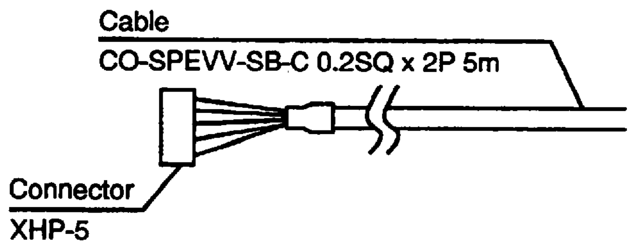
EXTERNAL SIGNAL INPUT/OUTPUT

Input from External Equipment

As shown in Table 4, the FR-1500 series accepts inputs from a wide variety of equipment. All external equipment are connected to the SPU Board, which is near the DJ connector at the rear of the display unit. A signal cable for connection to the asterisk-marked connectors in the figure below can be supplied. It is S03-55-5 (XHP-5 5P connector at one end, armor, vinyl sheath w/2-pair cable, 5 meters).

XHP-5 connector wiring

Terminal no.	Wire color	
1	BROWN	pair
2	RED	
3	ORANGE	pair
4	YELLOW	
5	BLACK	



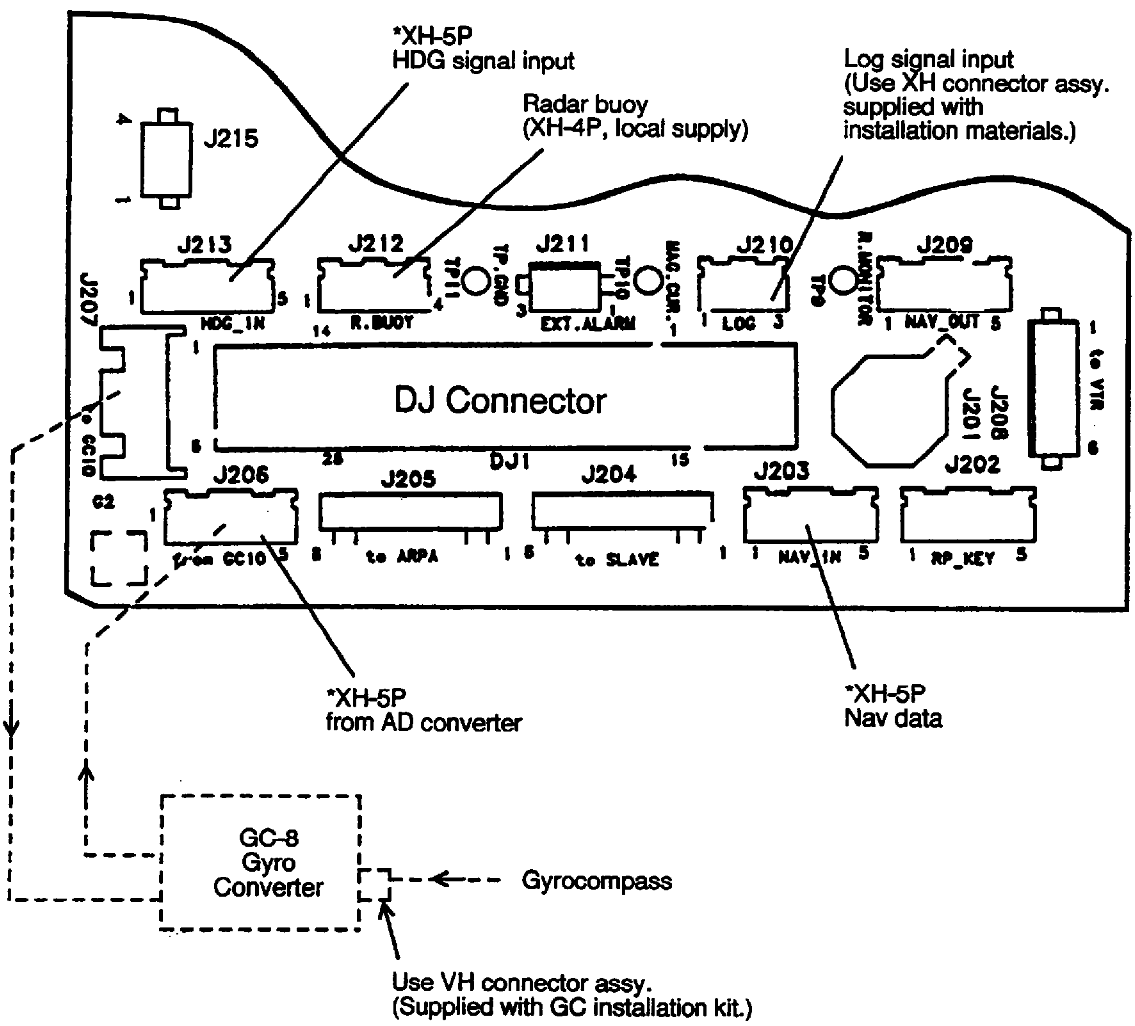


Figure 22a Location of connectors on SPU Board

Table 4 External signal input connector (SPU Board)

Signal	Connector	Connector no.	Connector type	Equipment (example)	Remarks
Heading signal	to GC-8	J207 (*1)	XH, 6 pin	GC-8A	UP, DOWN, HOLD
	from GC-8	J206	XH, 5 pin	AD-10S, AD-100, GC-8A	AD-10 format
	HDG IN	J213	XH, 5 pin	C-2000	HDG (NMEA format)
Speed log signal	LOG	J210	XH, 3 pin	DS-70, DS-30, MF-220, CI-60	200 pulses/nm, etc.
Nav data (L/L, wpt, time, TD, course, water temp., depth)	NAV IN	J203	XH, 5 pin	GP-3100, GP-50M2, GP-188, FCV series, T-2000, TI-20	(*2)
Slave display input signal	—	DJ1	28 pin		When used to connect a slave display, input heading, bearing, video and trigger signals through DJ connector.
Radar buoy signal	for R. BUOY	J212	XH, 4 pin		
Heading, water temp., depth	HDG IN	J213	XH, 5 pin	T-2000, TI-20	(*3)

**1 Requires PC board 64P1106 (option).*
**2 Requires interface (IF-2901, etc.) to input position, water temperature and depth.*
**3 HDG IN connector can accept water temperature or depth data (NMEA) in lieu of heading signal.*

Output to External Equipment

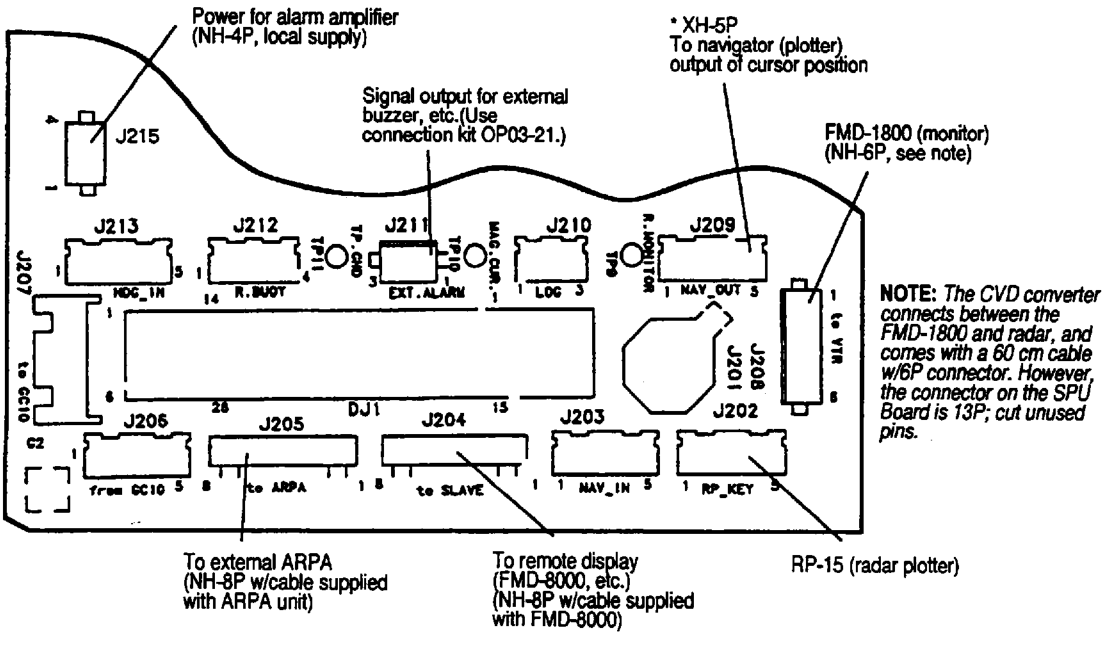


Figure 22b Location of connectors on SPU Board

Table 5 External signal output connector (SPU Board)

Signal	Connector	Connector no.	Connector type	Equipment (example)	Remarks
ARPA signal	to ARPA	J205	NH, 8 pin	FA-2800, etc.	heading marker, bearing, video, tx trigger
Slave display signal	to SLAVE	J204	NH, 8 pin	CD-140, CD-141, GD-500, FMD-800, FMD-8000 (*1)	heading marker, bearing, video, true trigger
Alarm signal	EXT ALARM	J211	NH, 3 pin	OP03-21-3	Buzzer drive signal
				Speaker w/amp	Speaker signal
Monitor signal	to VTR	J208	NH, 6 pin	FMD-1800 (*2)	Horizontal synch, vertical synch, video (NTSC format)
Radar signal (serial data)	NAV OUT	J209	XH, 5 pin	To navigator (plotter)	NMEA 0183 $RATLL $RARSD

**1 Display unit for FR-1505/1510/1525 M2, FR-7041/7111 can be used as slave display unit.*
**2 Display horizontal and vertical are reversed.*

Connection of external speaker, buzzer

An external speaker or buzzer can be connected to this radar via an amplifier circuit (local supply), as shown in the figure below. Ground the amplifier to nearby connector's ground terminal.

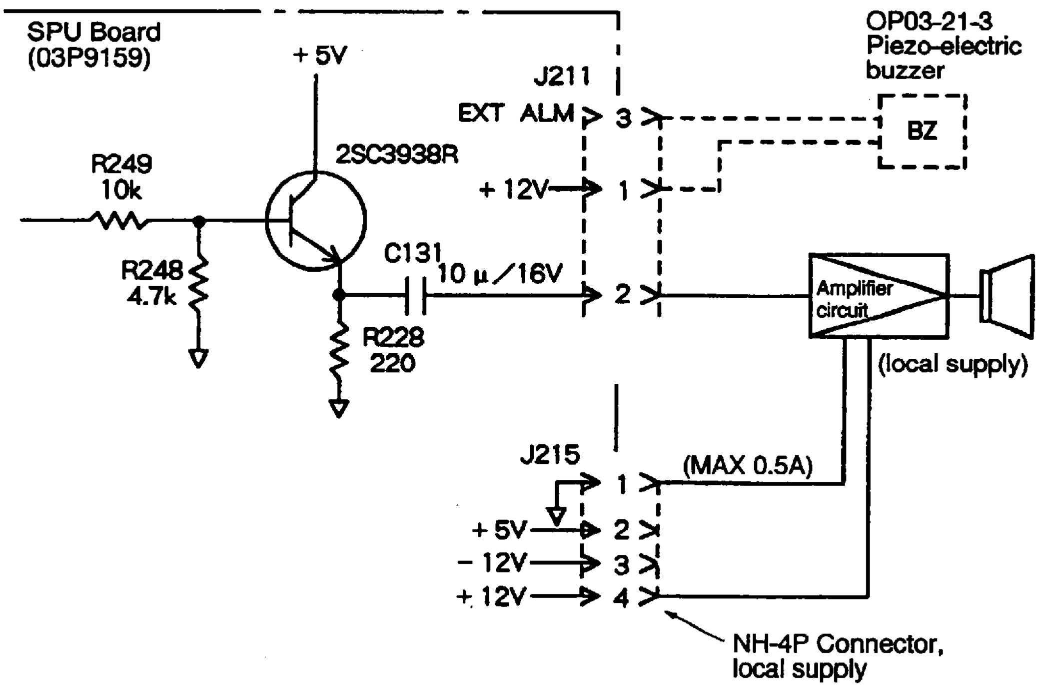


Figure 23 Connection of external speaker or buzzer to the SPU Boaard

NMEA I/O data

The FR-1500 series accepts the following nav data input/output sentences.

Receivable NMEA 0183 sentences

Input/Output	Receive sentence
Speed	RMA>RMC>VTG>VHW
Heading (true)	HDT>VHW>HDG>HDM
Heading (relative)	RMA>RMC>VTG
Course (true)	RMA>RMC>VTG
Course (magnetic)	VTG>RMA>RMC
Waypoint (range/bearing)	RMB>BWC>BWR
Ship;'s position	RMA>RMC>GLL
Loran TD	RMA>GLC>GTD
Time	ZDA
Water temperature	MDA>MTW

Transmittable NMEA 0183 sentences

Input/Output	Transmit sentence
Target position (cursor latitude and longitude)	RAATLL
Radar system data *	RARSD
Target message ** when equipped w/ARP-15	RATTM

* *Origin mark range and bearing, EBL bearing, VRM range, cursor range and bearing, etc.*

** *Target no., range, bearing, course, speed, CPA, TCPA, etc. Outputted from J2 #1/#2 on the ARP Board.*

CHANGING POWER SPECIFICATIONS

This radar can operate by either 12V, 24V or 32V power. (12V operation is available for FR-1505/1510 M2, but is not available with the FR-1525 M2 or the 36 rpm scanner unit.) Power specification can be changed from 12V to 24V/32V and vice versa by jumper wire JP1 and the power fuse F1351.

Input voltage rating (at terminal board in display unit)

12V DC: 10.2 to 15.0 V DC
24V/32V DC: 20.4 to 40.0V DC

Procedure

1) Remove the display cover.
2) Remove rear panel of display unit by unfastening five screws. Unfasten three screws securing the POWER Board.

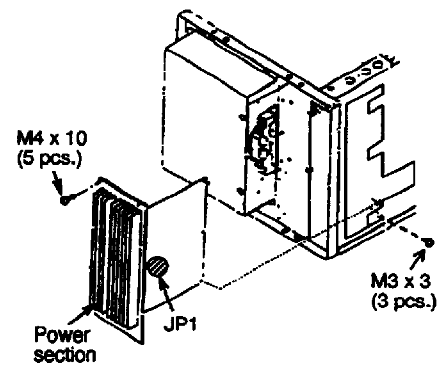


Figure 24 Display unit, rear view

3) Unplug connectors on the POWER Board and remove the board.
4) Attach jumper wires as shown in below. Jumper JP1 is on underside of the transformer.

   <u>**12V DC spec.**</u>

   Attach jumper wires between ①-②, ③-④, ⑤-⑥, and ⑦-⑧.

   <u>**24V/32V DC spec.**</u>

   Attach jumper wires between ②-③ and ⑥-⑦.

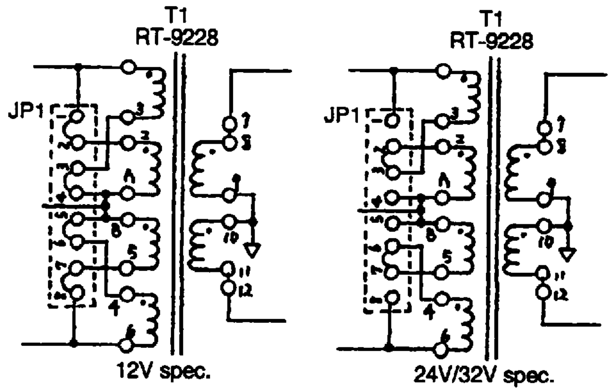


Figure 25 Location of jumper JP1 on transformer

5) Change fuse as follows.

   12V DC spec.: 20A
   24V/32V DC spec.: 10A

6) Reassemble the power section.

ADJUSTMENT

Initial, Installation Menus

Many presettings and adjustments are done on the INITIAL and INSTALL menus. Below and on the next page are menu trees for these menus. Factory settings shown in bold.

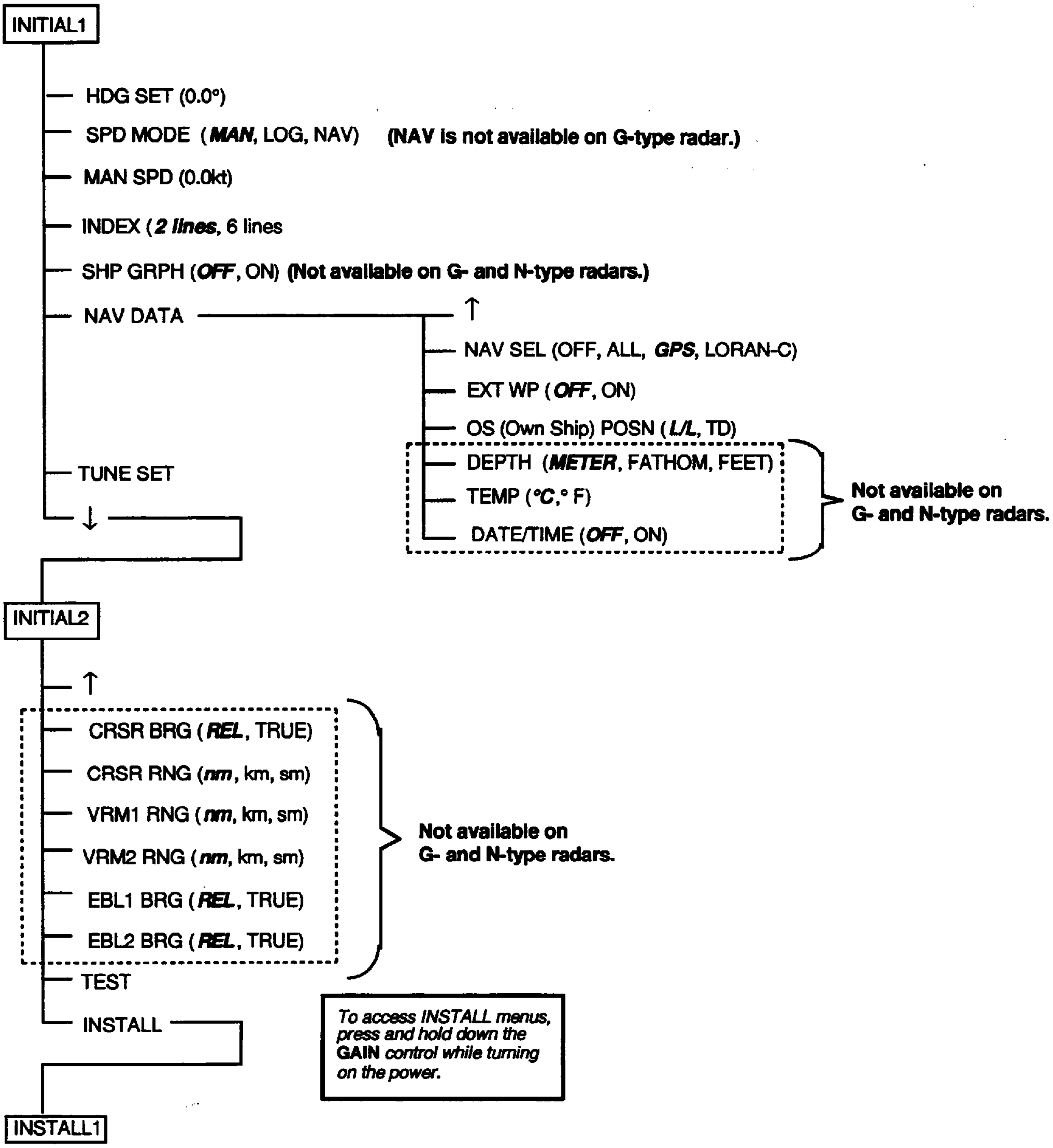


Figure 26 INITIAL menus

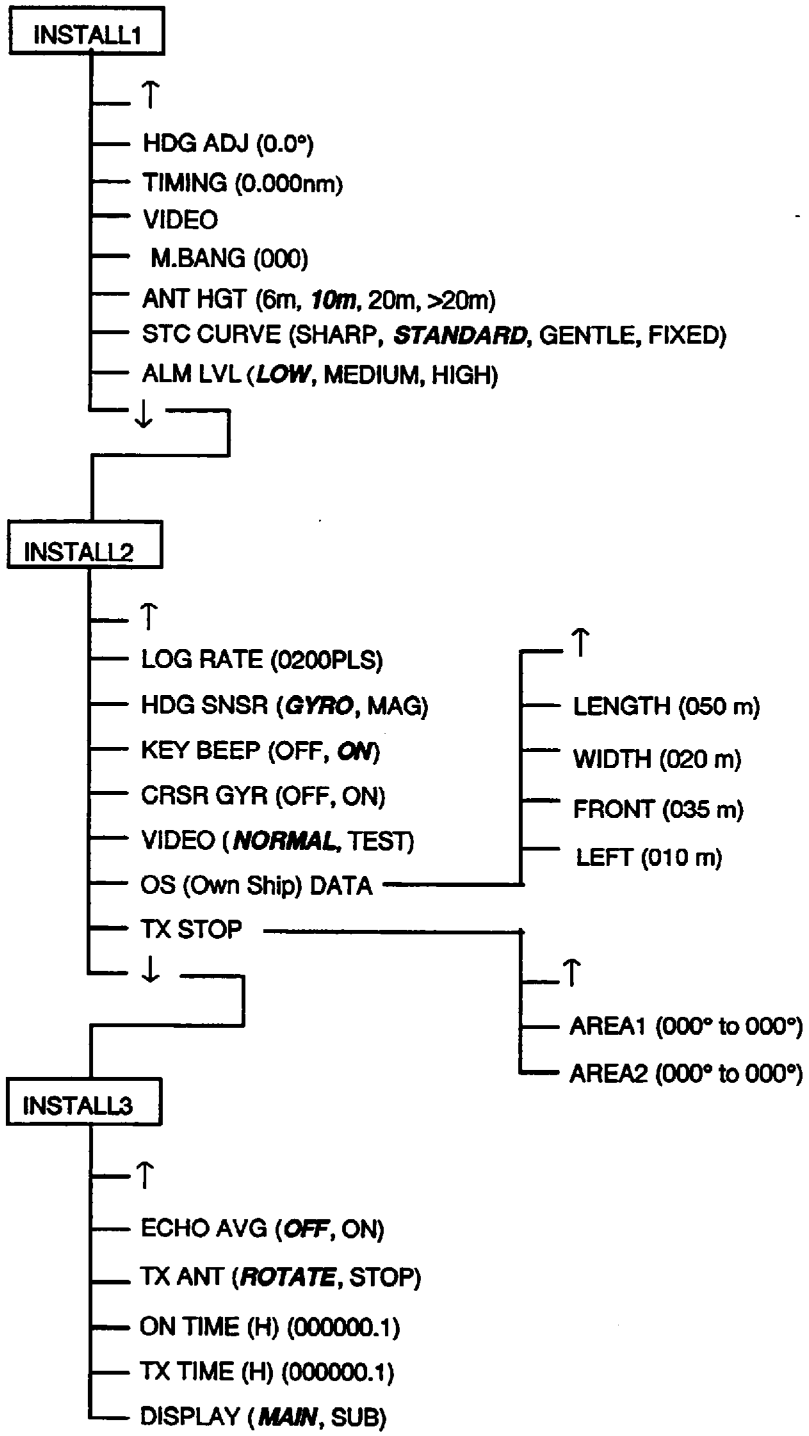


Figure 27 INSTALL menus

Working With the INSTALL Menus

Accessing the INSTALL menus

While pressing and holding down the **GAIN** control, turn on the power.

Displaying the INSTALL menus

Press the **MENU** key about two seconds to display the INITIAL menu. Select INSTALL on the INITIAL2 menu and press the **ENTER** key.

Selecting items on menus

1) Operate the VRM or EBL encoder to select menu.
2) Press the **ENTER** key.
3) Operate the VRM or EBL encoder to change setting.
4) Press the **ENTER** key.

Closing the menu

Press the **MENU** key.

Changing pages

Next page: Place cursor on ↓ and press the **ENTER** key.

Previous page: Place cursor on ↑ and press the **ENTER** key.

Clearing wrong data

Press the **CLEAR** key.

1. Tuning the Receiver

Initial setting

With the radar transmitting, do the following;

On the INITIAL1 menu, select TUNE SET and press the ENTER key. The unit automatically tunes the receiver, displaying the indication AUTO TUNING at the bottom of the menu while tuning. When tuning is completed, the indication disappears. (This procedure records both peak value for the TUNE indicator and automatic coarse tuning.)

2. Sweep Timing Adjustment

Sweep timing depends on the length of the signal cable (between the display unit and the scanner unit). Adjust it as shown in the procedure below to prevent pushing in pulling out of targets as shown in the Figure 28.

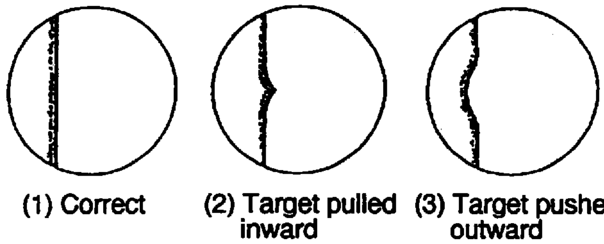


Figure 28 Examples of proper and improper sweep timing

1) Select TIMING on the INSTALL1 menu and press the **ENTER** key.
2) Transmit on the 0.125 nautical mile range, and visually select a target which forms right angles (harbor wall, etc.).
4) Operate the VRM encoder to straighten target selected in step 3. For reference, amount "straightened" in nautical miles appears at bottom right side on the display.
5) Press the **ENTER** key.

3. Video Amplifier Input Level Adjustment

The longer the signal cable the lower the video amplifier level input and thus the smaller targets appear on the display. Do the following to adjust video amplifier level input.

1) Transmit on a long range.
2) On the INSTALL1 menu, select VIDEO and press the **ENTER** key.

At the bottom of the menu AUTO ADJ. appears. The indication disappears when adjustment is completed.

4. Main Bang Suppression (MBS)

Main bang, which appears at the display center on short ranges, can be suppressed as follows.

1) Transmit on long range about 10 minutes.
2) Adjust the gain to show a small amount of noise on the display.
3) Change to the 0.125 nautical mile range and adjust the **A/C SEA** control.
4) Select M. BANG on the INSTALL1 menu.
5) Press the **ENTER** key.
6) Operate the VRM encoder to suppress main bang
7) Press the **ENTER** key.

5. Heading Alignment

The scanner unit is mounted facing straight ahead in the direction of the bow. Therefore, a small but conspicuous target dead ahead visually should appear on the heading mark. In practice, however, there will be some error on the display because of the difficulty in achieving accurate initial positioning of the scanner unit. Do the following to compensate for error.

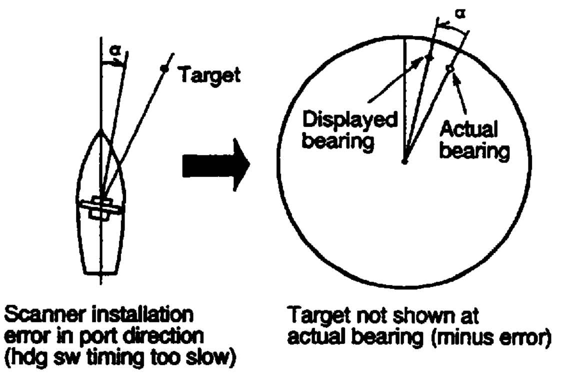


Figure 29 Plus heading error

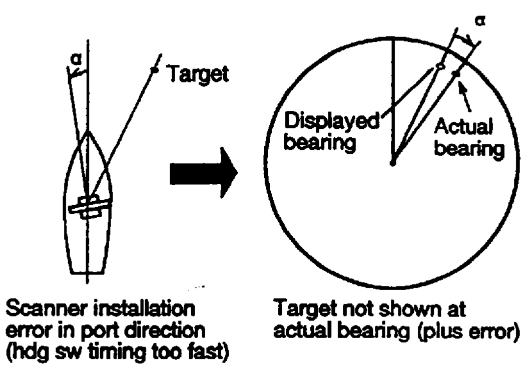


Figure 30 Minus heading error

1) Identify a suitable target (by gyrocompass, for example) at a range between 0.125 to 0.25 nautical miles, preferably near the heading mark.
3) Open the INSTALL1 menu and select HDG ADJ.
4) Press the **ENTER** key.
5) Operating the VRM encoder, bisect the target by the EBL. The value at the bottom right of the menu shows antenna position in relation to ship's bow (0°).
6) Press the **ENTER** key.

6. STC Curve Adjustment

Open the INSTALL1 menu and enter antenna height and best STC curve.

Antenna height: Enter antenna height above the waterline as accurately as possible.

STC curve: Select STC curve by expected average sea conditions.

7. Presetting the FUNCTION key

The **FUNCTION** key provides one-touch adjustment of STC, pulselength, and other controls. Eight types of target setups are available (see Table 6 on next page) and three can be preset on the FUNC KEY menu.

1) Press the **FUNCTION** key and select function number (FUNC1, FUNC2, or FUNC3) to set.
2) Select FUNC KEY on the main menu.
3) Place the cursor on the FUNC SEL.

```
FUNC ( 1 )

FUNC
   S1  OFF
ECHO AVG
       OFF
INTRF
       OFF
STRETCH
       OFF
A/C AUTO
       OFF
NOISE
       OFF
P/L SEL
       OFF
```

The (factory) settings of these items may be changed. However, since each item is set considering target objective, any change may prevent obtainment of objective.

To restore factory settings, select appropriate function again and close the menu.

Figure 31 Function setting display

4) Press the **ENTER** key.

5) Operate the VRM encoder to select settings.

6) Press the **ENTER** key.

To set another function number (2 or 3), erase the menu and then repeat steps 1 to 5.

NOTE: *When the main menu displays FUNC KEY*, this means no function is active and the FUNCTION key is inoperative. To select a function, erase the menu and press the FUNCTION key.*

Table 6 Function objectives

Item	Description
S1 (Short range 1)	Short range navigation (within 1.5 nm); for example, when approaching a a harbor.
S2 (Short range 2)	Short range navigation within 3 nm.
S & M (Short and Medium ranges)	General navigation on ranges within 12 nm.
L-ES (Long range-cho Stretch)	Magnify target echoes on 6 nm range and higher ranges.
L-STC (Long range-STC)	Suppress sea surface reflections on 3 nm range and higher ranges.
ES (Echo Stretch)	Magnify target echoes on 1.5 nm range and higher ranges.
B1 (Buoy 1)	Detect echoes from small targets (various buoys, small vessels, floats, etc.) on ranges within 1.5 nm.
B2 (Buoy 2)	Detect small targets on ranges greater than 1.5 nm.

8. Preventing Transmission in an Area

When the scanner is installed at a close distance in front of the wheelhouse and this presents an rf radiation hazard, the radar should be set not to transmit within that area. This feature can also be used to prevent transmission in a blind or shadow sector. Two areas can be set.

Procedure

1) Display the INSTALL2 menu.

2) Select TX STOP.

3) Press the **ENTER** key.

4) Select AREA 1 or AREA 2.

5) Press the **ENTER** key.

6) Enter start of area by operating the VRM encoder.

7) Press the **ENTER** key.

8) Enter end of area by operating the VRM encoder.

9) Press the **ENTER** key.

Deleting no transmission area

Enter 000° as end of area.

9. Selecting Navigator

On the INITIAL1 menu, select NAV SEL and navigator which feeds position data to the radar.

10. Other Items on the INSTALL Menus

Table 7 Other items on INSTALL menus

Item, INSTALL menu no.	Description
Alarm level, #2	Set echo strength which will trigger the guard alarm. Note that the HIGH setting can trigger alarm on sea clutter.
Log pulse ratio, #2	Enter log pulse ratio.
Heading sensor, #2	Select heading sensor which feeds heading data to the radar.
Key response, #2	Turn on or off key beep.
Video signal, #2	Normally set to NORMAL.
Own ship data, #2	Turn on SHP GRPH on the INITIAL1 menu, and enter own ship data to accurately depict own ship graphic (on the display) on INSTALL2 menu.
Transmitting while scanner is stopped, #2	Radar pulses can be transmitted with scanner rotation suspended, for servicing, etc.
Echo averaging and no gyro, #3	Turn off echo averaging when no gyro is connected.
Display unit function, #3	Select function of display unit: main or slave display.

Installation Checklist

After completing the installation, check it for completeness following the checklist shown below. Check asterisk-marked items if they apply to the installation.

- ❐ Tuning circuit adjustment
- ❐ Video level adjustment
- ❐ Main bang suppression
- ❐ Sweep timing adjustment
- ❐ Heading alignment
- ❐ Antenna height selection, STC curve selection
- ❐ FUNCTION key presetting
- ❐ *Entry of area of no transmission
- ❐ *Setting of GC-8A
- ❐ *Selection of navigator
- ❐ Setting up of INITIAL menus
- ❐ *Entry of log pulse ratio
- ❐ *Selection of heading sensor
- ❐ Disabling of echo averaging when no gyrocompass is connected
- ❐ Setting up of INSTALL menus
- ❐ *Confirmation of heading set (coincidence with gyro reading)

INSTALLATION OF GC-8A (OPTION)

Installation Kit

Table 8 Contents of GC-8A installation kit

Name	Type	Code No.	Qty
GYRO CONVERTER Board	64P1106	004-412-200	1
Spacer	SQ-10	000-801-678	4
Washerhead Screw	M3 x 8	008-456-404	4
PH-XH Connector	03-1761 (14P-6P)	008-456-130	1
NH-XH Connector	03-1762 (5P-5P)	008-456-140	1
Label	64-014-2021-1	100-132-701	1
VH Connector Assy.	03-1763 (5P)	008-456-150	1
VH Connector Assy.	03-1764 (3P)	008-456-160	1
Spare Fuses (4 pcs.)	FGMB 2A 250V	000-122-000	4

NOTE: *Other parts may be contained with the installation kit; use only the parts noted in Table 8. Unrelated parts may be discarded.*

Installation and Connection

1) Remove rear cover.
2) Attach spacers as shown below.

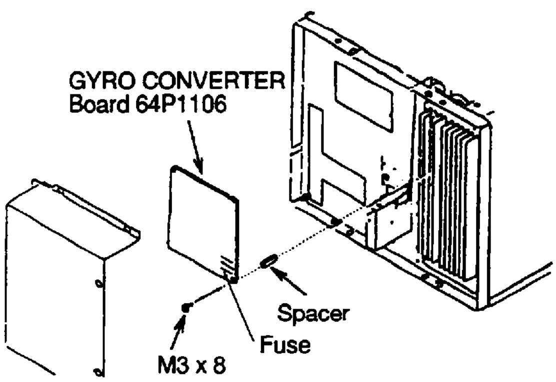


Figure 32 Display unit, rear view

3) Install the GYRO CONVERTER Board (64P1106).
4) Connect the GYRO CONVERTER Board to the SPU Board as follows;

GYRO CONV. Board (64P1106)		SPU Board (03P9159)
J1 (14P)	←→	J207 (6P)
J7 (5P)	←→	J206 (5P)

5) Set DIP switches and jumper wires on the GYRO CONVERTER Board according to gyrocompass. See the next page.
6) Solder the connection cable from the gyrocompass to the VH connector assembly. Connect the VH connector assembly to the GYRO CONVERTER Board as follows;

Connector		Step type	Synchro type
J4	#1	S1	S1
	#2	S2	S2
	#3	S3	S3
	#4		
	#5	F. G.	F. G.
J5	#1	—	R2
	#2	COM	R1
	#3	F. G.	F. G.

7) Attach instruction label (supplied) to rear side of rear cover for GYRO CONVERTER Board.

Using an external power supply

An external power supply is necessary when the repeater signal is step type and the step voltage is less than 20V, or when the gyrocompass cannot deliver more than 5W of power. Connect an external power supply to the GYRO CONVERTER Board as shown below.

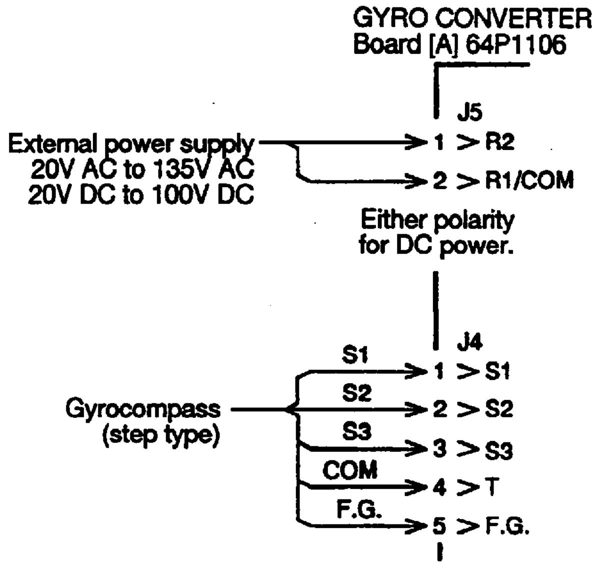
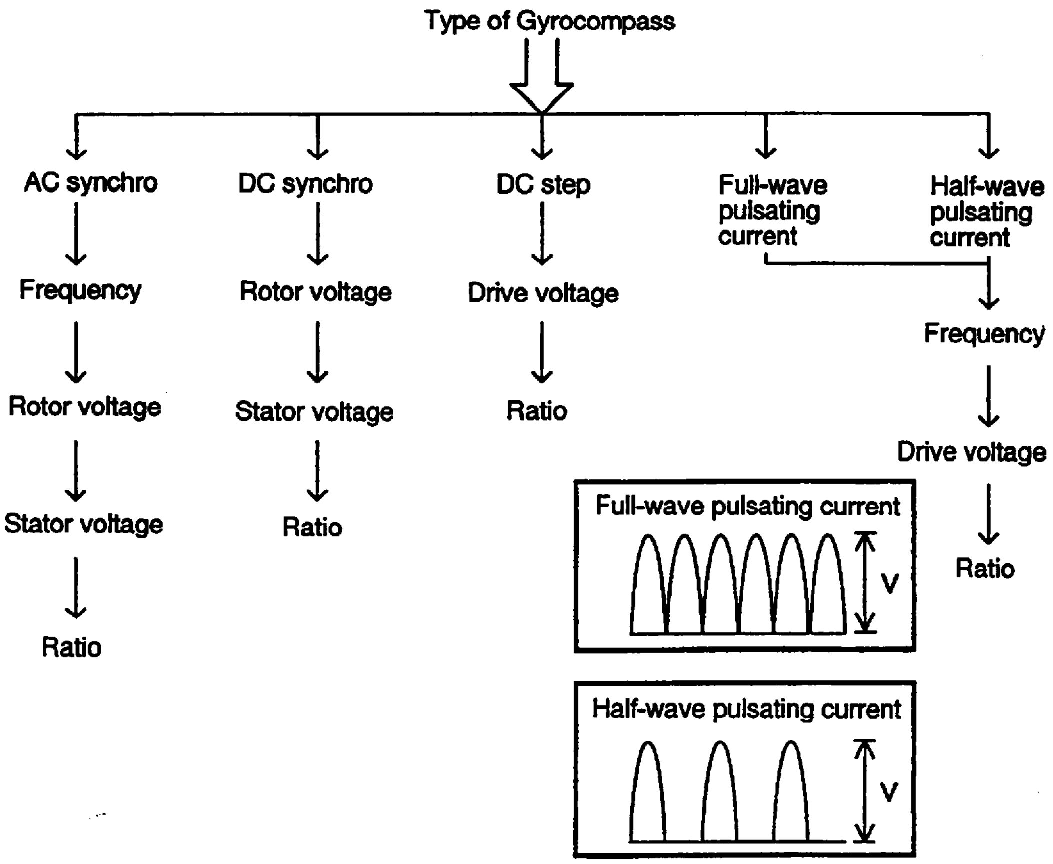


Figure 33 Connection of external power supply to the GYRO CONVERTER Board

Confirming Gyrocompass Specifications

Follow the flow chart at the bottom of this page to confirm gyrocompass specifications.



Changing Settings of the GYRO CONVERTER Board

Set the DIP switches and jumper wires on the GYRO CONVERTER Board by specification of gyrocompass.

1) Gyro type

Gyro	SW 1-4	SW 1-5	SW 1-6	JP1
AC synchro	OFF	OFF	OFF	#1, #2, #3
DC synchro	OFF	OFF	OFF	#2, #3, #4
DC step	ON	OFF	OFF	#4, #5, #6
Full-wave pulsating current	OFF	ON	OFF	#4, #5, #6
Half-wave pulsating current	ON	ON	OFF	#4, #5, #6

2) Frequency

Frequency	SW 1-7	SW 1-8	Remarks
50/60Hz	OFF	OFF	AC synchro pulsating current
400Hz	ON	OFF	AC synchro pulsating current
500Hz	OFF	ON	AC synchro pulsating current
DC	ON	ON	DC synchro DC step

3) Rotor voltage (between R1 and R2)

Rotor voltage	SW 2-1	JP3
20V to 45V AC	OFF	#2
30V to 70V AC	OFF	#2
40V to 90V AC	ON	#1
60V to 135V AC	OFF	#1

4) Stator voltage (between S1 and S2)

Stator voltage	SW2-2	SW 2-3	JP3
20V to 45V AC, or 20V to 60V DC	ON	OFF	#2
30V to 70V AC, or 40V to 100V DC	OFF	OFF	#2
40V to 90V AC	ON	OFF	#1
60V to 135V AC	OFF	OFF	#1

5) Ratio

Ratio	SW1-1	SW 1-2	SW1-3
360x	OFF	OFF	OFF
180x	ON	OFF	OFF
90x	OFF	ON	OFF
36x	ON	ON	OFF

6) Supply voltage

Supply voltage	JP4	JP5
20V to 45V AC, or 20V to 60V DC	#2	#2
30V to 135V AC, or 40V to 100V DC	#1	#1

7) AD-10 format data transmitting interval

Jumper wires JP6 and JP7 set the data transmitting intervals of data output ports 1 through 6. Two intervals are available: 25msec and 200msec. For radar the interval must be 25msec. For other equipment use 200msec.

8) NMEA-0183 data transmitting interval

Set NMEA-0183 data output synchronization (J6).

Tx interval	SW2-4
2 seconds	ON
1 second	OFF

9) Reset the CPU by turning on and off either the power or DIP switch S2-8.

NOTE: *Sometimes the bearing displayed on the radar is different from that of the gyrocompass despite correct connections and settings. In this case try exchanging two connections among S1, S2 and S3.*

Setting of Heading

Allow the gyrocompass to stabilize and then follow the procedure below.

1) Press the **MENU** key.
2) Open the INITIAL1 menu and select HDG SET.
3) Press the **ENTER** key.
4) Operate the VRM encoder to set heading.
5) Press the **ENTER** key.

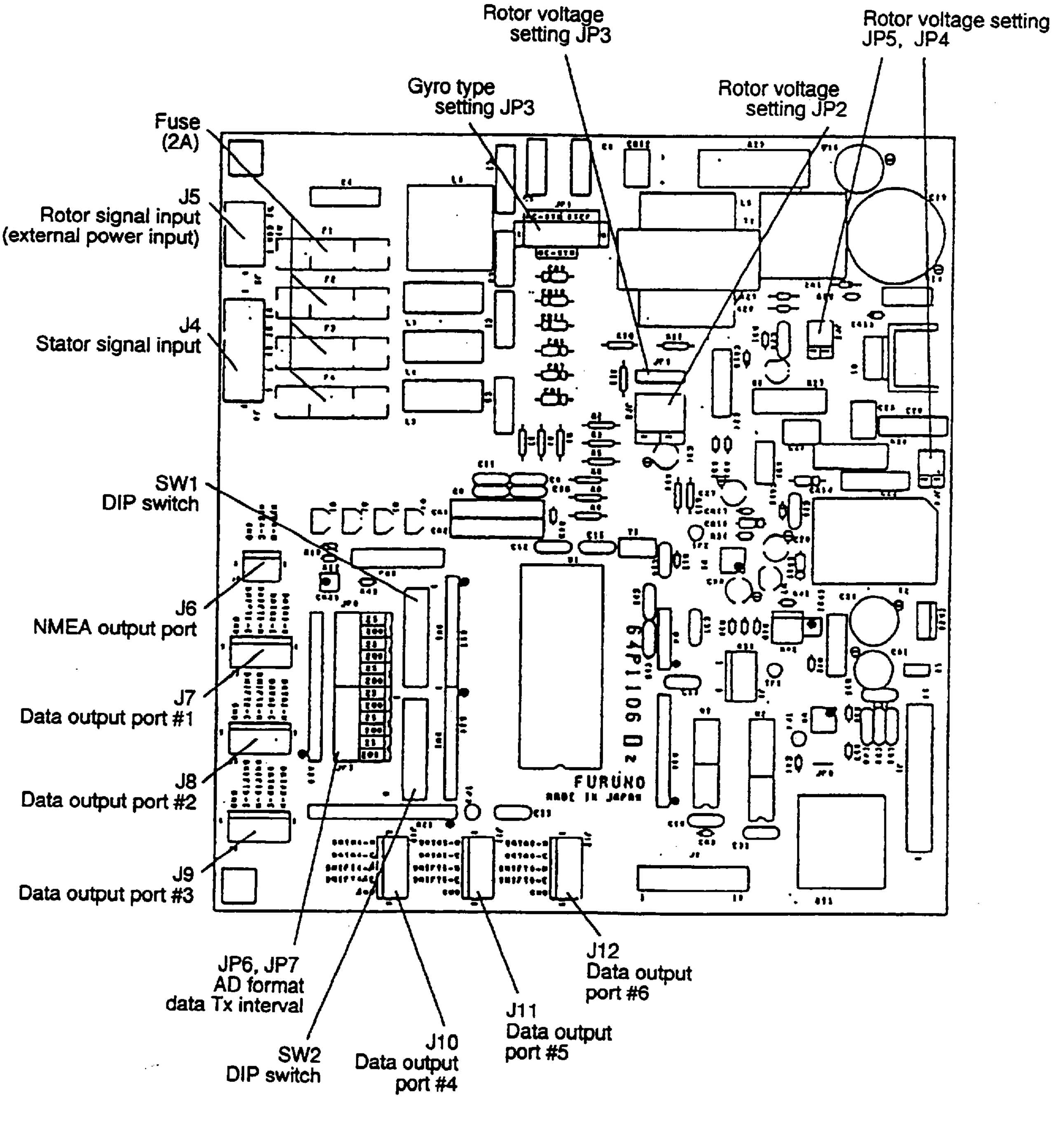


Figure 34 GYRO CONVERTER Board (64P1106)

Table 9 DIP switch and jumper wire settings on the GYRO CONV. Board by make and model of gyrocompass

Revised at Feb. 1, 1996

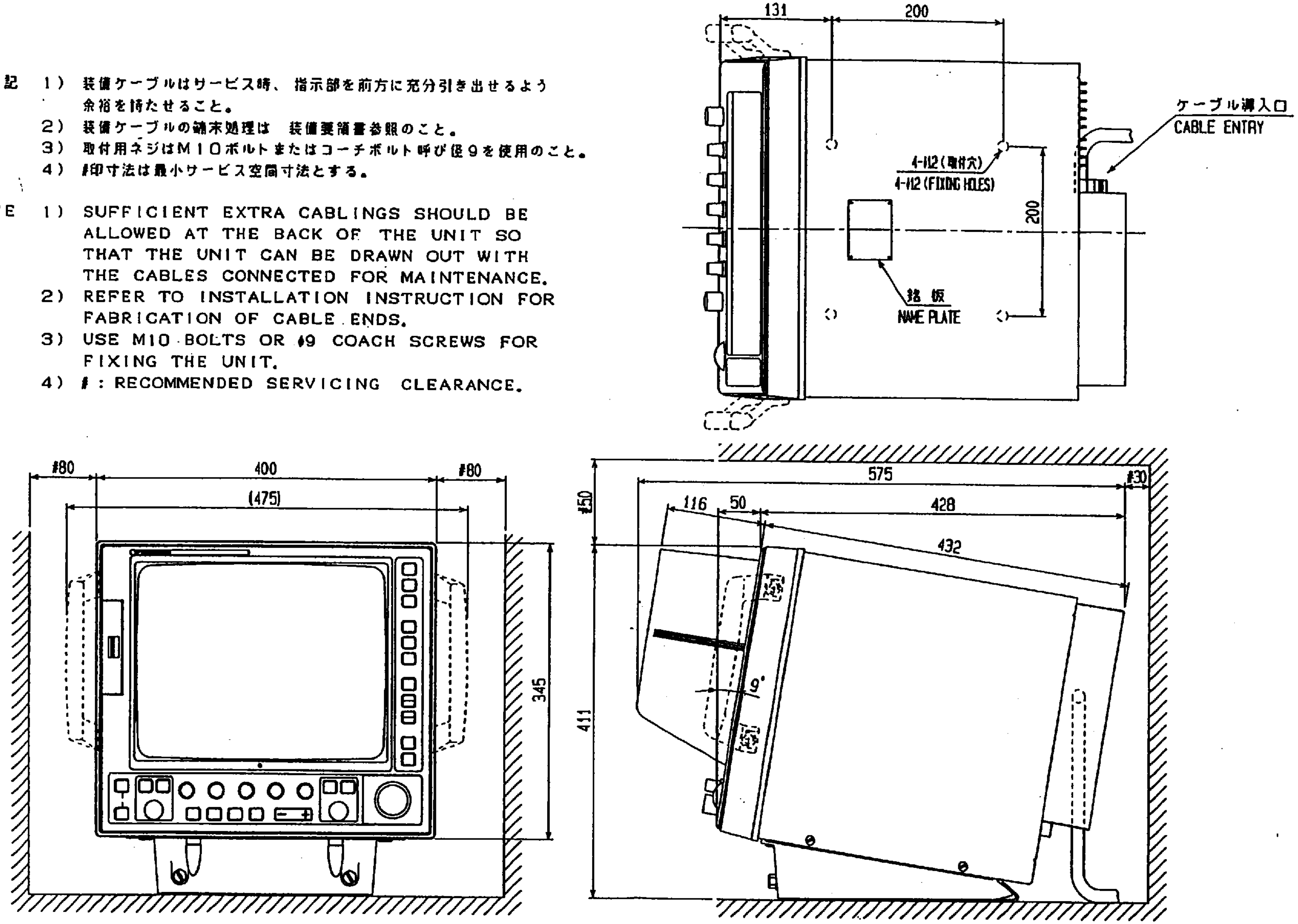
Maker	Models	Specification	SW 1-1	SW 1-2	SW 1-3	SW 1-4	SW 1-5	SW 1-6	SW 1-7	SW 1-8	SW 2-1	SW 2-2	SW 2-3	JP1	JP2	JP3	JP4	JP5
FURUNO	GY-700	DC step 100V 180x 5-wire, open collector	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	OFF	OFF	#4, #5,#6	#2	-	#1	#1
Anschutz	Standard 2,3	AC synchronous 50/60Hz Rotor voltage: 50/60V Stator voltage: 22V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	#1, #2,#3	#2	#2	#1	#1
	Standard 4,6	AC synchronous 50/60Hz Rotor voltage: 50/60V Stator voltage: 90V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#2	#1	#1	#1
	Standard 20	DC step 35V 180X COM(-) 3-wire (+)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	#4, #5,#6	#2	-	#2	#2
Yokogawa Navtec (Plaith type)	C-1/1A/2/3 A-55, B-55	AC synchronous 50/60Hz Rotor voltage: 50/60V Stator voltage: 22V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	#1, #2,#3	#2	#2	#1	#1
	CMZ-250X/ 300X/500	DC synchronous 360X	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	-	ON	OFF	Remove	#2	-	*	*
		DC step 35V 180X COM (+) 3-wire (-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	#4, #5,#6	#2	-	#2	#2
	CMZ-100/200/ 300 C-1Jr,D-1Z/1/ 3 IPS-2/3	AC synchronous 50/60Hz Rotor voltage: 100V Stator voltage: 90V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
	CMZ-50 Note 2	step 35V 180X COM (+) 3-wire (-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	Remove	#2	-	*	*
Plaith	NAVGAT II/III	AC synchronous 50/60Hz Rotor voltage: 50/60V Stator voltage: 68V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#2	#2	#1	#1
Tokimec (Sperry type)	ES-1/2/11 GLT-101/102/ 103/106K/107	AC synchronous 50/60Hz Rotor voltage: 100/110V Stator voltage: 90V 36x	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
	ES-11A/110 TG-200 PR222R/2000 PR237L/H GM 21	AC synchronous 50/60Hz Rotor voltage: 100/110V Stator voltage: 22V 90x	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
	MK-14 MOD-1/2/T NK-EN,NK-EI	DC step 70V 180x COM(-), 3-wire(+)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	OFF	OFF	#4, #5,#6	#2	-	#1	#1
	SR-130/140	DC step 70V 180x 5-wire, open collector	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	-	OFF	OFF	#4, #5,#6	#2	-	#1	#1
	TG-100/5000 PR-357/130/ 140, ES-17 GLT-201/202/ 203	DC step 70V 180x COM(+), 3-wire(-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	OFF	OFF	#4, #5,#6	#2	-	#1	#1
	TG-6000	DC step 24V 180x	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	#4, #5,#6	#2	-	#2	#2
	GM-11	AC synchronous 50/60Hz Rotor voltage: 100V Stator voltage: 90V 90X	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
	SR-120,ES-16 MK-10/20/30	DC step 35V 180x	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	#4, #5,#6	#2	-	#2	#2
Kawasaki	GX-81	AC synchronous 50/60Hz Rotor voltage: 100/110V Stator voltage: 90V 90x	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
Armabrown	MK-10,MKL-1 SERIES1351, MOD-4	DC step 50V 180x COM(+), 3-wire(-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	OFF	OFF	#4, #5,#6	#2	-	#1	#1
Robertson	SKR-80	DC step 35V 180x COM(-), 3-wire(+)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	#4, #5,#6	#2	-	#2	#2

Note1) *: Set JP4 and JP5 according to the voltage of the external power supply.
Note 2) If CMZ-50 has 35VDC, set JP1 to #4, #5, #6.

FURUNO

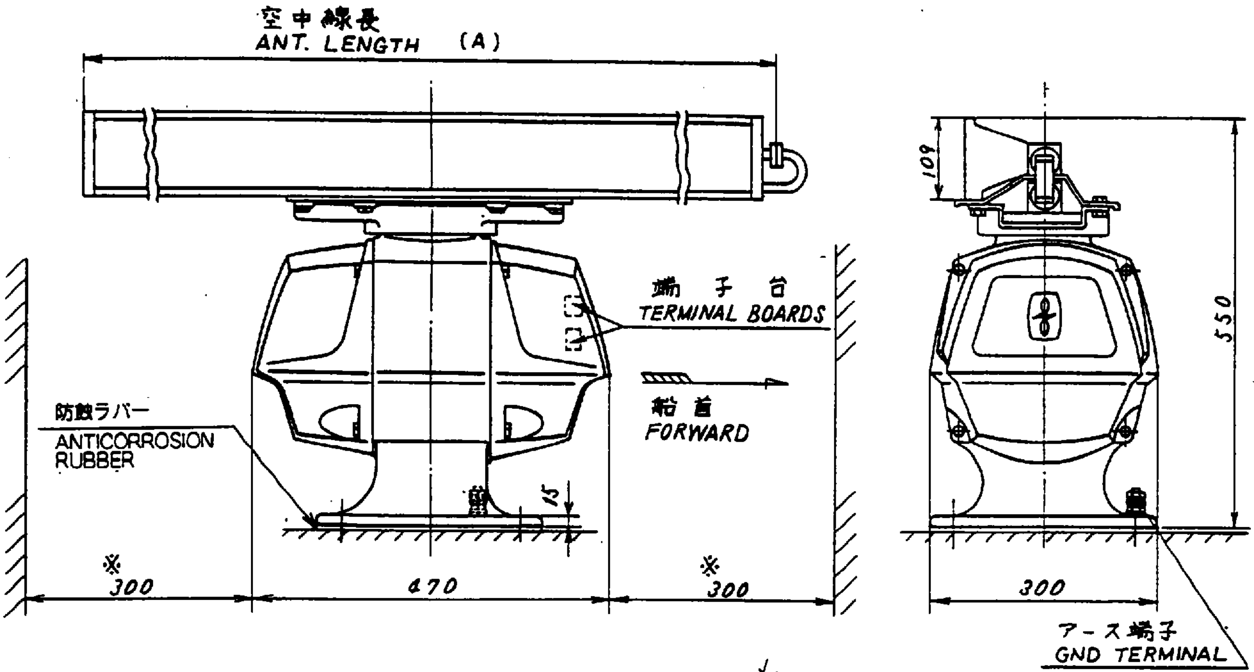
注記
1) 装備ケーブルはサービス時、指示部を前方に充分引き出せるよう余裕を持たせること。
2) 装備ケーブルの端末処理は 装備要領書参照のこと。
3) 取付用ネジはM10ボルトまたはコーチボルト呼び径9を使用のこと。
4) #印寸法は最小サービス空間寸法とする。

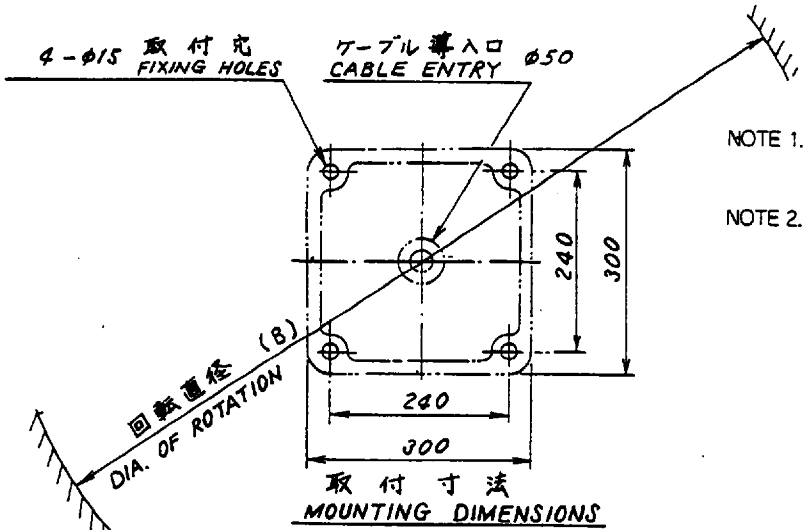
NOTE
1) SUFFICIENT EXTRA CABLINGS SHOULD BE ALLOWED AT THE BACK OF THE UNIT SO THAT THE UNIT CAN BE DRAWN OUT WITH THE CABLES CONNECTED FOR MAINTENANCE.
2) REFER TO INSTALLATION INSTRUCTION FOR FABRICATION OF CABLE ENDS.
3) USE M10 BOLTS OR #9 COACH SCREWS FOR FIXING THE UNIT.
4) # : RECOMMENDED SERVICING CLEARANCE.

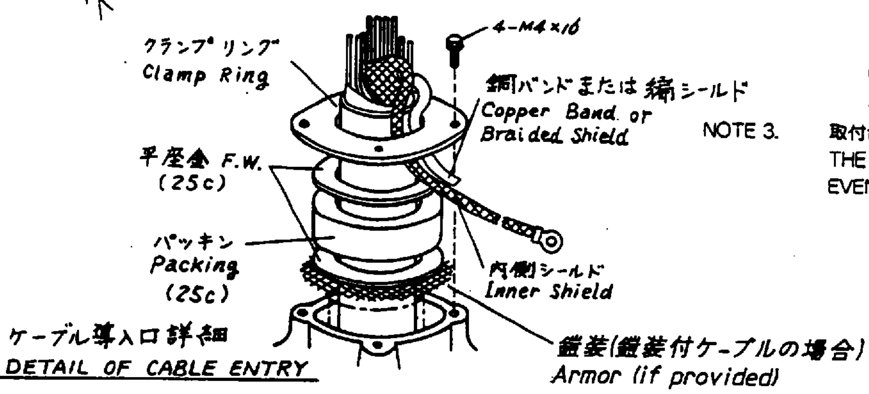


REMARKS	FR1525M2 FR1510M2 FR1505M2	TYPE	RDP-111
DRAWN K.M	APPROVED Nov. 7 '94 IKEDA	名称	指示部
SCALE	MASS 20 kg	NAME	DISPLAY UNIT
APPLICABLE TO: (MODEL)	BLOCK NO.	DWG NO.	C3398-G01- B

FURUNO ELECTRIC CO., LTD.







NOTE 1. ※：推奨サービス空間
RECOMMENDED SERVICING CLEARANCE

NOTE 2.

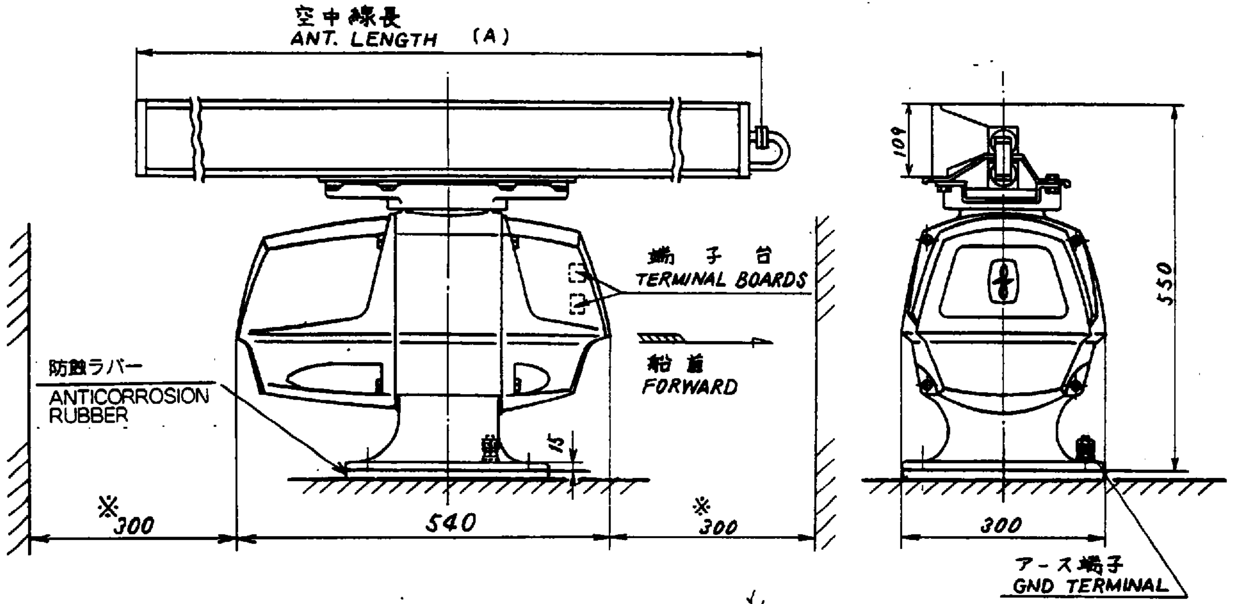
種類※※ ANT. TYPE	90cm 型 TYPE	123cm 型 TYPE	200cm 型 TYPE
空中線長 ANT. LENGTH (A)	910mm	1250mm	2000mm
回転直径 DIA. OF ROTATION (B)	1100mm	1400mm	2200mm
質量 MASS	32kg	33kg	37.5kg

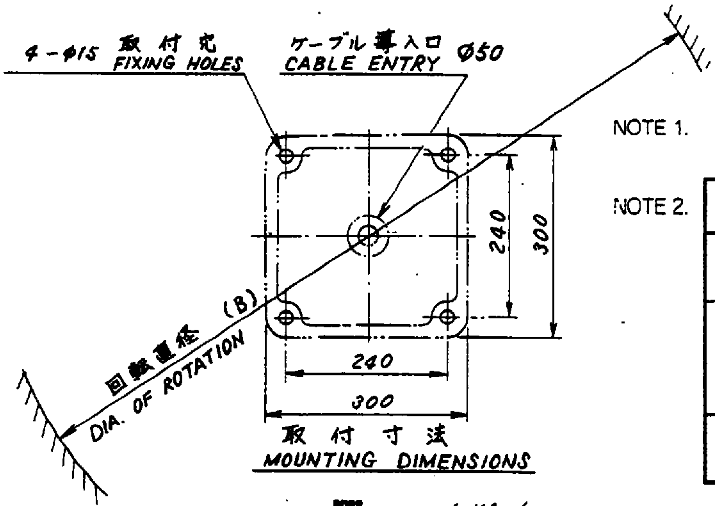
※※選択可能な空中線部種類はレーダー型式により異なる。各仕様を参照のこと。
SELECTABLE ANTENNA TYPE DEPENDS ON RADAR MODEL. SEE INDIVIDUAL SPECIFICATIONS.

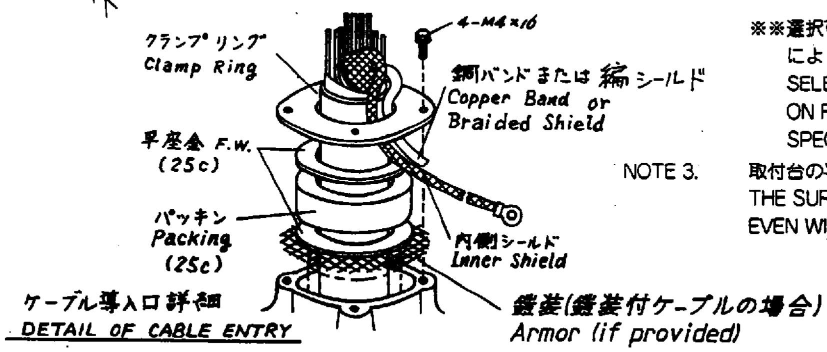
NOTE 3. 取付台の平面度は±1mm以内のこと。
THE SURFACE OF PLATFORM SHOULD BE EVEN WITHIN ±1mm.

REMARKS XN1/2/3		TYPE RSB0063/C2P7N2N/C2P8N2N
		名称 空中線部
DRAWN K.M	APPROVED	FR1510M2 FR2110	NAME RADAR SCANNER UNIT
SCALE 1/10	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	DWG NO. C3237-001- U

FURUNO ELECTRIC CO., LTD.







NOTE 1. ※：推奨サービス空間
RECOMMENDED SERVICING CLEARANCE

NOTE 2.

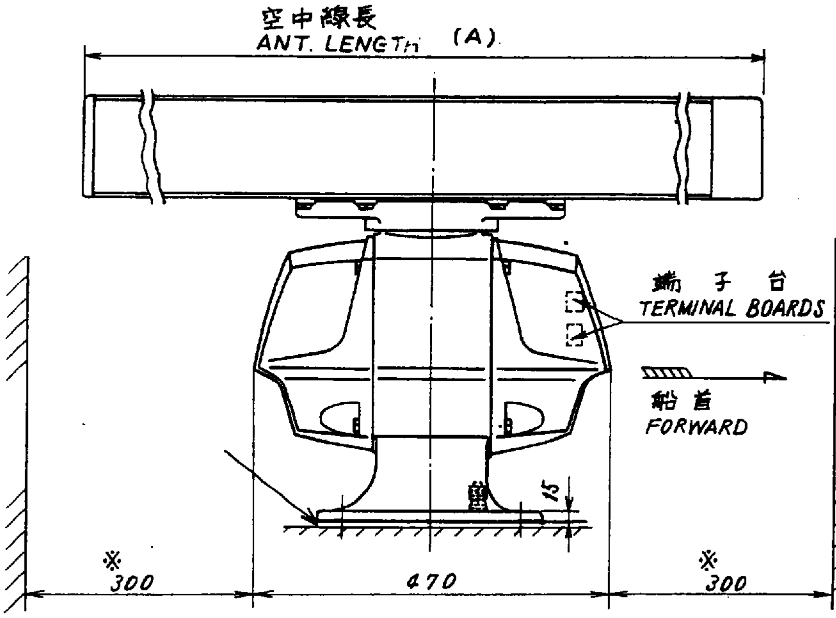
種類※※ ANT. TYPE	123cm 型 TYPE	200cm 型 TYPE
空中線長 ANT. LENGTH (A)	1250mm	2000mm
回転直径 DIA. OF ROTATION (B)	1400mm	2200mm
質量 MASS	35kg	40kg

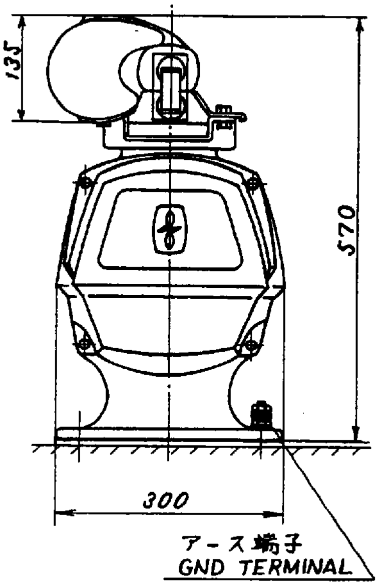
※※選択可能な空中線部種類はレーダー型式により異なる。各仕様を参照のこと。
SELECTABLE ANTENNA TYPE DEPENDS ON RADAR MODEL. SEE INDIVIDUAL SPECIFICATIONS.

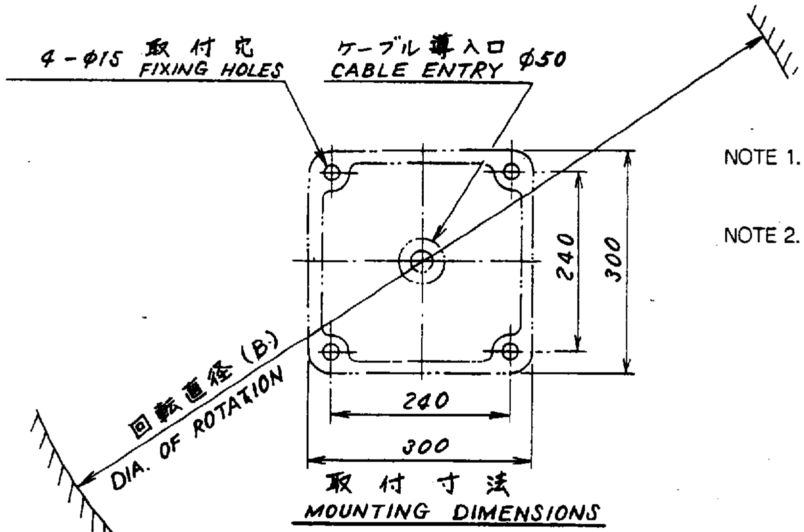
NOTE 3. 取付台の平面度は±1mm以内のこと。
THE SURFACE OF PLATFORM SHOULD BE EVEN WITHIN ±1mm.

REMARKS		TYPE
XN2／3		RSB0014/RSB0064
		名称 空中線部
DRAWN K.M / APPROVED NOV 7'94 IKEDA	FR1525M2 FR2120	NAME RADAR SCANNER UNIT
SCALE 1/10 / MASS kg	APPLICABLE TO: (MODEL) / BLOCK NO.	DWG NO. C3290-004- J

FURUNO ELECTRIC CO., LTD.







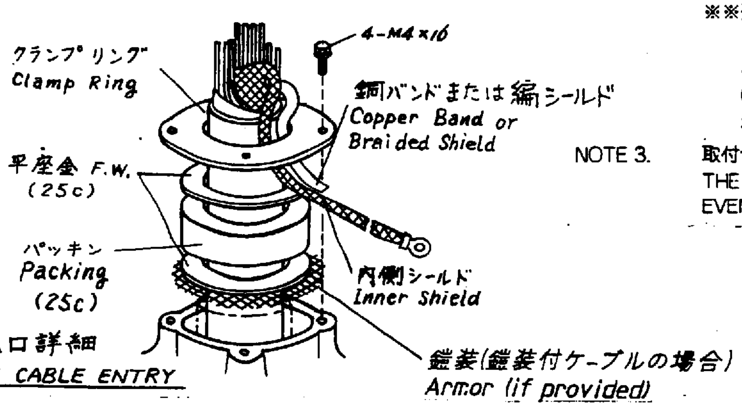
NOTE 1. ※：推奨サービス空間
RECOMMENDED SERVICING CLEARANCE

NOTE 2.

種類※※ ANT. TYPE	200cm 型 TYPE (XN-3A)	240cm 型 TYPE (XN-4A)
空中線長 ANT. LENGTH (A)	2070mm	2570mm
回転直径 DIA. OF ROTATION (B)	2200mm	2700mm
質量 MASS	36.5 kg	38.5kg

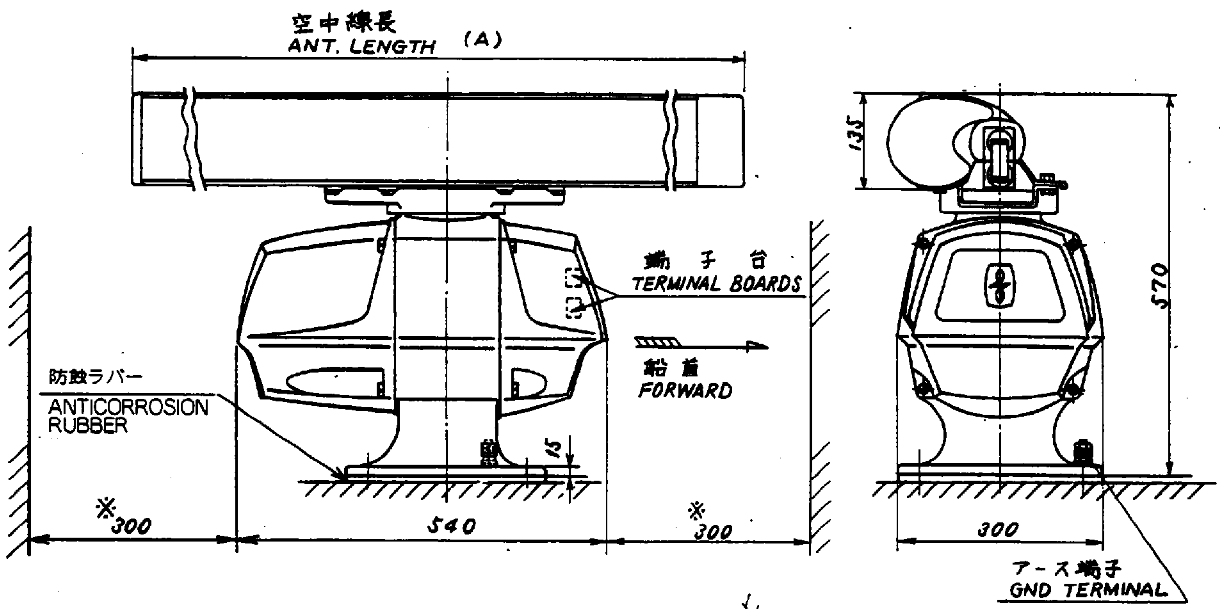
※※選択可能な空中線部種類はレーダー型式により異なる。各仕様を参照のこと。
SELECTABLE ANTENNA TYPE DEPENDS ON RADAR MODEL. SEE INDIVIDUAL SPECIFICATIONS.

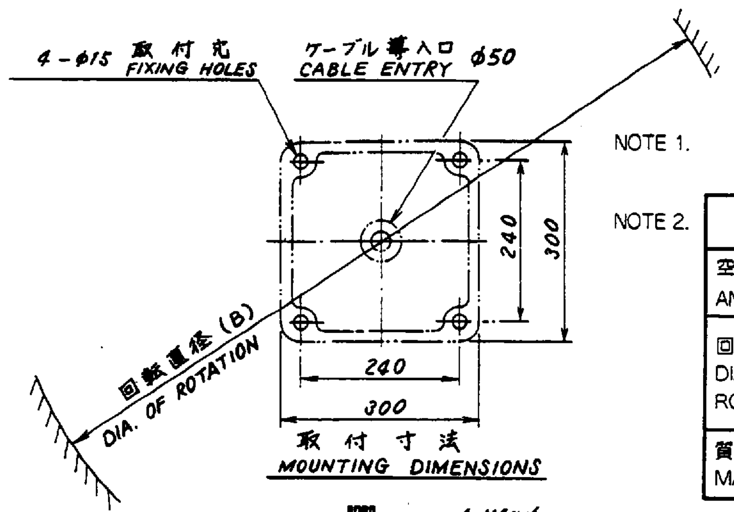
NOTE 3. 取付台の平面度は±1mm以内のこと。
THE SURFACE OF PLATFORM SHOULD BE EVEN WITHIN ±1mm.



ケーブル導入口詳細
DETAIL OF CABLE ENTRY

REMARKS XN3A／4A			TYPE RSB0063/C2P7N2N/C2P8N2N 名称 空中線部 NAME RADAR SCANNER UNIT
DRAWN K.M	APPROVED	FR1510M2 FR2110	
SCALE 1/10	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	DWG NO. C3249-011- P





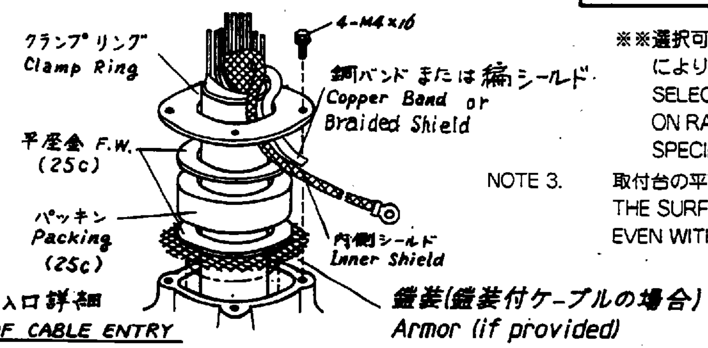
NOTE 1. ※：推奨サービス空間
RECOMMENDED SERVICING CLEARANCE

NOTE 2.

種類※※ ANT. TYPE	200cm 型 TYPE (XN-3A)	240cm 型 TYPE (XN-4A)
空中線長 ANT. LENGTH (A)	2070mm	2570mm
回転直径 DIA. OF ROTATION (B)	2200mm	2700mm
質量 MASS	39kg	42kg

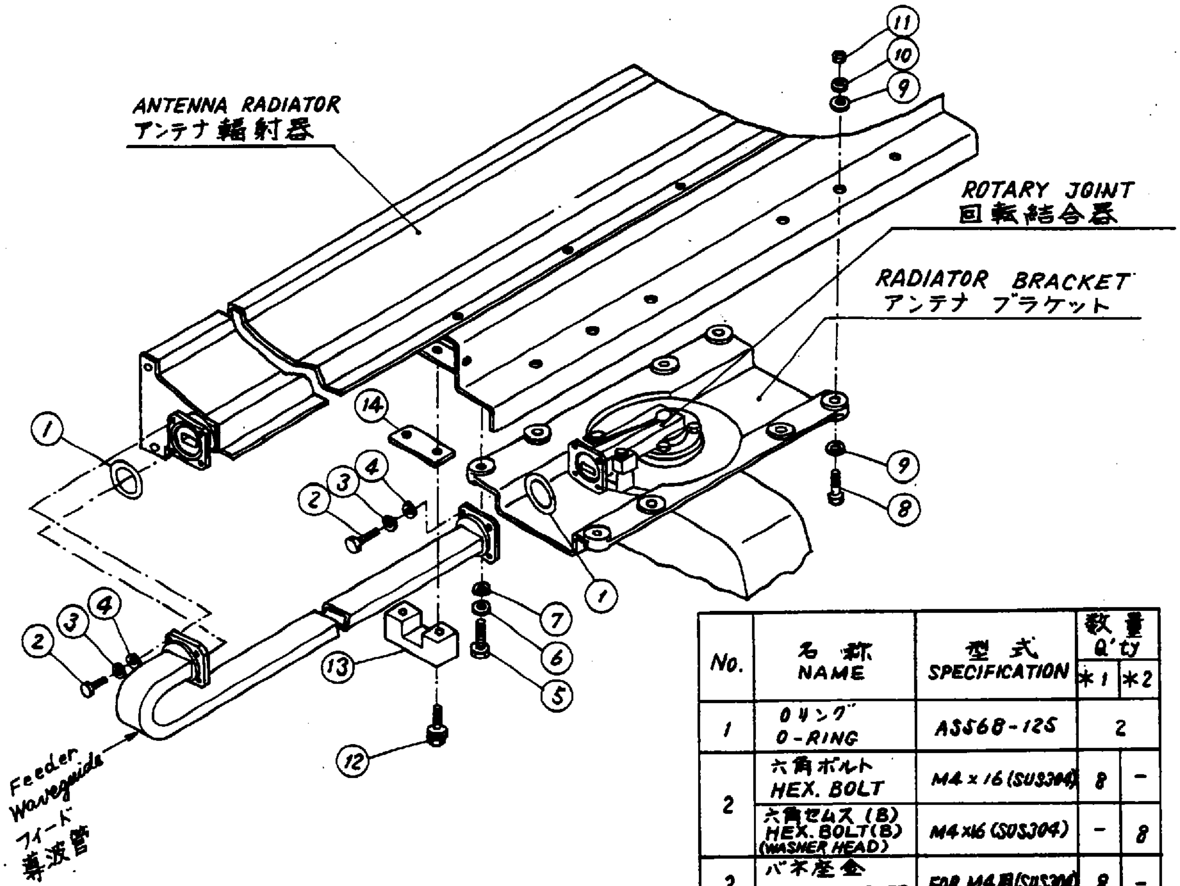
※※選択可能な空中線部種類はレーダー型式により異なる。各仕様を参照のこと。
SELECTABLE ANTENNA TYPE DEPENDS ON RADAR MODEL. SEE INDIVIDUAL SPECIFICATIONS.

NOTE 3. 取付台の平面度は±1mm以内のこと。
THE SURFACE OF PLATFORM SHOULD BE EVEN WITHIN ±1mm.



ケーブル導入口詳細
DETAIL OF CABLE ENTRY

REMARKS XN3A/4A			TYPE RSB0014/RSB0064
			名称 空中線部
DRAWN K.M	APPROVED NOV 7 '94 IKEDA	FR1525M2 FR2120	NAME RADAR SCANNER UNIT
SCALE 1/10	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	DWG NO. C3290-003- J



No.	名称 NAME	型式 SPECIFICATION	数量 Q'ty *1	*2
1	Oリング O-RING	AS568-125	2	
2	六角ボルト HEX. BOLT	M4×16(SUS304)	8	-
	六角セムス(B) HEX. BOLT(B) (WASHER HEAD)	M4×16(SUS304)	-	8
3	バネ座金 SPRING WASHER	FOR M4用(SUS304)	8	-
4	平座金 FLAT WASHER	FOR M4用(SUS304)	8	-
5	六角ボルト HEX. BOLT	M8×25(SUS304)	4	-
	六角セムス(A) HEX. BOLT(A) (WASHER HEAD)	M6×25	-	6
6	バネ座金 SPRING WASHER	FOR M8用(SUS304)	4	-
7	平座金 FLAT WASHER	FOR M8用(SUS304)	4	-
		RSG-1002-0	-	6
8	六角ボルト HEX. BOLT	M8×30(SUS304)	4	6
9	平座金 FLAT WASHER	FOR M8用(SUS304)	8	12
10	バネ座金 SPRING WASHER	FOR M8用(SUS304)	4	6
11	六角ナット HEX. NUT	M8(SUS304)	4	6
12	六角セムス(B) HEX. BOLT(B) (WASHER HEAD)	M4×25	-	2
13	導波管押え W/G CLAMP	RSB-2006-1	-	1
14	導波管パッキン W/G PACKING	RSB-2008-0	-	1

*1: 900/1230mm アンテナ用 (XN-1/2)
FOR 900/1230mm RADIATOR (XN-1/2)

*2: 2000mm アンテナ(XN-3)用
FOR 2000mm RADIATOR (XN-3)

注意:
1. 電蝕防止のため、組立時にボルト、ナット、ワッシャ及びフランジ面のOリング溝外側の部分に支給のシリコンシール剤(無酸性)を塗布する。Oリング及びOリングの溝には塗布しないこと。
2. Oリングに傷をつけたり、ゴミを付着させないように注意のこと。
3. Oリング及びスキャナーカバーのパッキンにはグリースを使用すること。シリコンシール剤は使用不可。

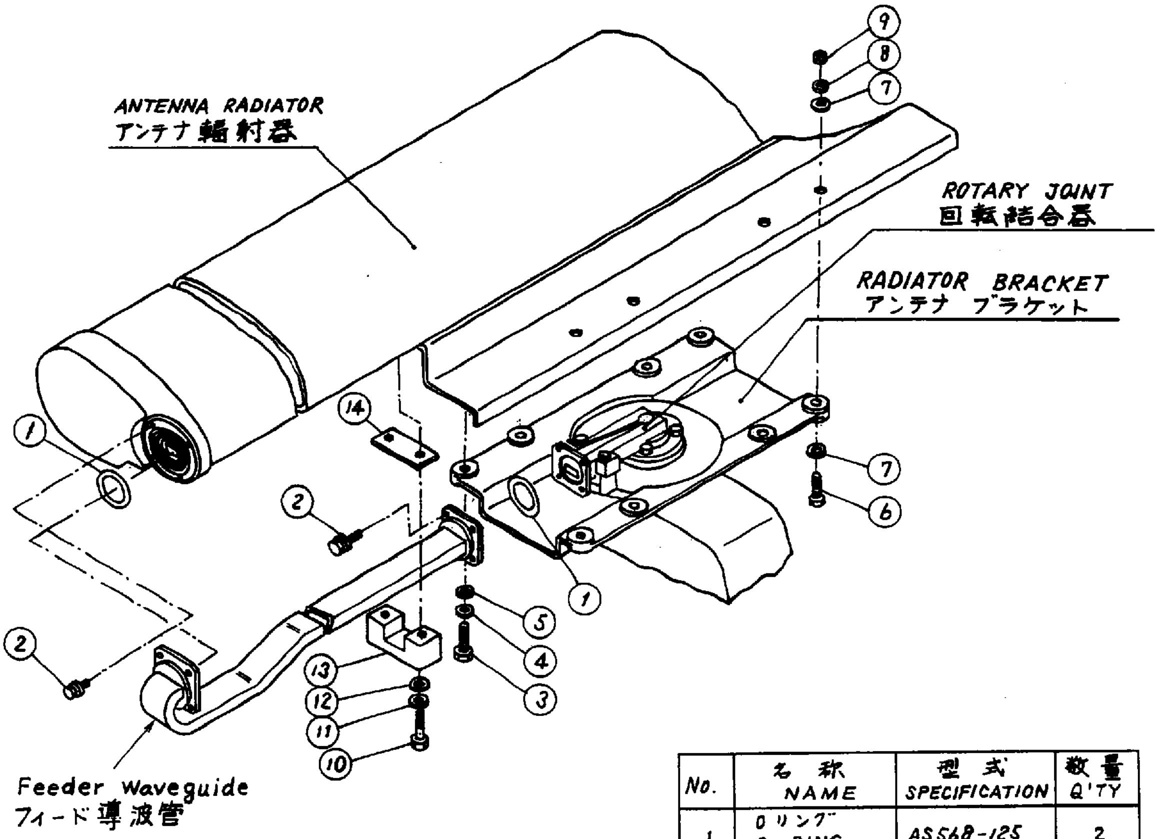
NOTE:
1. APPLY SILICONE SEALANT (SUPPLIED, NON-ACID TYPE) ON BOLTS, NUTS, WASHER AND WAVEGUIDE FLANGE OUTSIDE O-RING GROOVE TO AVOID ELECTRICAL CORROSION. (DO NOT APPLY SEALANT TO O-RINGS AND O-RING GROOVES.)
2. DO NOT PINCH O-RING AND KEEP IT CLEAN.
3. FOR PACKINGS OF SCANNER COVERS AND O-RINGS, DO NOT USE SILICONE SEALANT, BUT RATHER USE GREASE.

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	摘要 REMARKS

承認 APPROVED	MAY. 25. '79	三角法 THIRD ANGLE PROJECTION	名称 TITLE 空中線部組立図 SCANNER UNIT ASSEMBLING 空中線長 ANT. LENGTH: 900, 1230 & 2000mm (XN-1/2/3)
検図 CHECKED	MAY. 25. '79	尺度 SCALE /	
製図 DRAWN	25. 5. '79	重量 WEIGHT kg	図番 DWG. NO. C3237-025-J

REV.: 2/83, 8/83, 7/88

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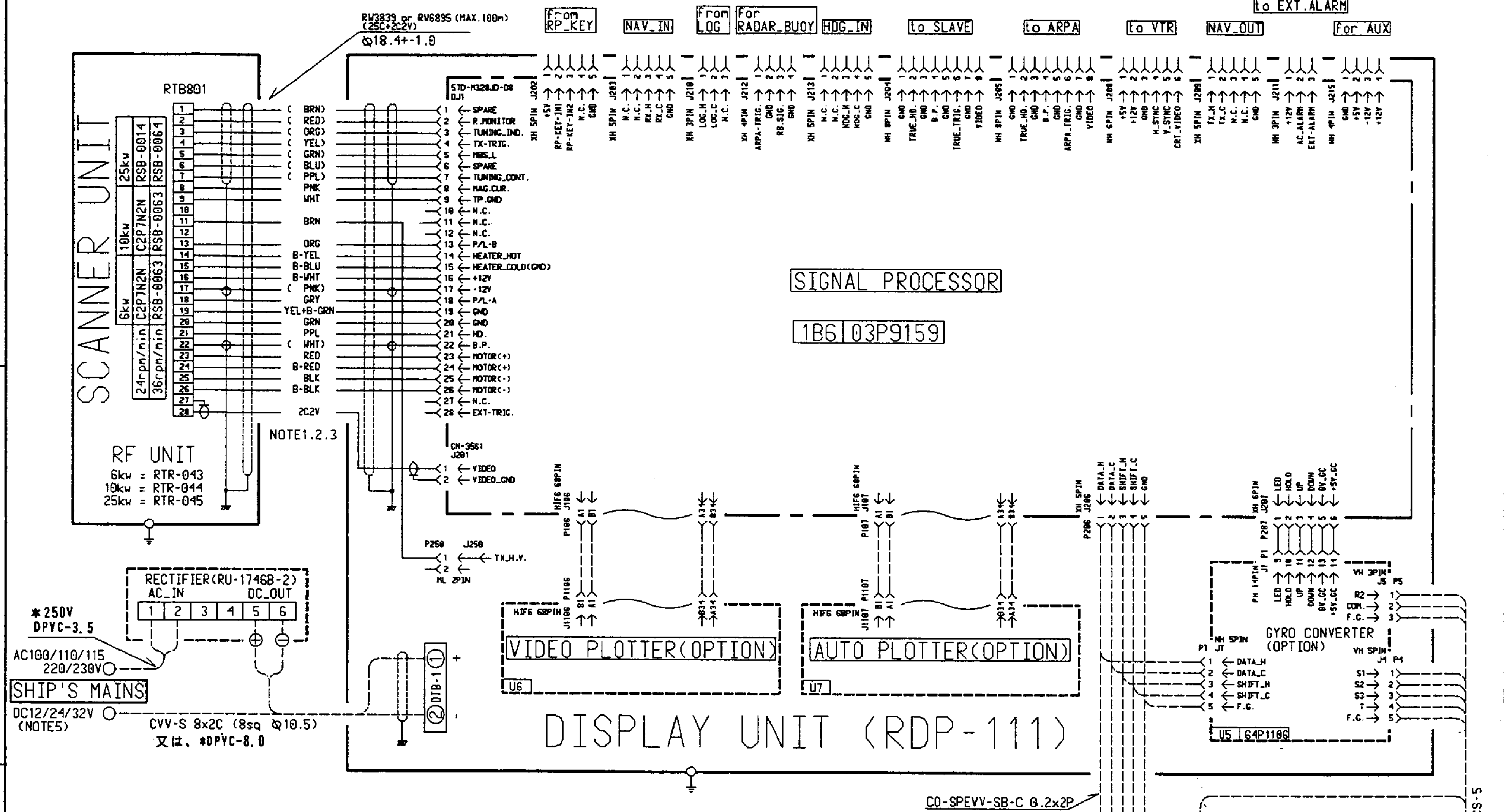
No.	名称 NAME	型式 SPECIFICATION	数量 Q'TY
1	Oリング O - RING	AS568-125	2
2	六角セムス(B) HEX. BOLT(B) (WASHER HEAD)	M4x16 (SUS304)	8
3	六角ボルト HEX. BOLT	M8x35(SUS304)	4
4	バネ座金 SPRING WASHER	FOR M8用(SUS304)	4
5	平座金 FLAT WASHER	FOR M8用(SUS304)	4
6	六角ボルト HEX. BOLT	M8x30 (SUS304)	4
7	平座金 FLAT WASHER	FOR M8用(SUS304)	8
8	バネ座金 SPRING WASHER	FOR M8用(SUS304)	4
9	六角ナット HEX. NUT	M8(SUS304)	4
10	六角ボルト HEX. BOLT	M4x30(SUS304)	2
11	バネ座金 SPRING WASHER	FOR M4用(SUS304)	2
12	平座金 FLAT WASHER	FOR M4用(SUS304)	2
13	導波管押え W/G CLAMP	RSB-2006-1	1
14	導波管間座 W/G PACKING	03-003-4003-0	1

注意:
1. 電蝕防止のため、組立時にボルト、ナット、ワッシャ及びフランジ面のOリング溝外側の部分に支給のシリコンシール剤(無酸性)を塗布する。Oリング及びOリングの溝には塗布しないこと。
2. Oリングに傷をつけたり、ゴミを付着させないように注意のこと。
3. Oリング及びスキャナーカバーのパッキンにはグリースを使用すること。シリコンシール剤は使用不可。

NOTE:
1. APPLY SILICONE SEALANT (SUPPLIED, NON-ACID TYPE) ON BOLTS, NUTS, WASHER AND WAVEGUIDE FLANGE OUTSIDE O-RING GROOVE TO AVOID ELECTRICAL CORROSION. (DO NOT APPLY SEALANT TO O-RINGS AND O-RING GROOVES.)
2. DO NOT PINCH O-RING AND KEEP IT CLEAN.
3. FOR PACKINGS OF SCANNER COVERS AND O-RINGS, DO NOT USE SILICONE SEALANT, BUT RATHER USE GREASE.

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	摘要 REMARKS

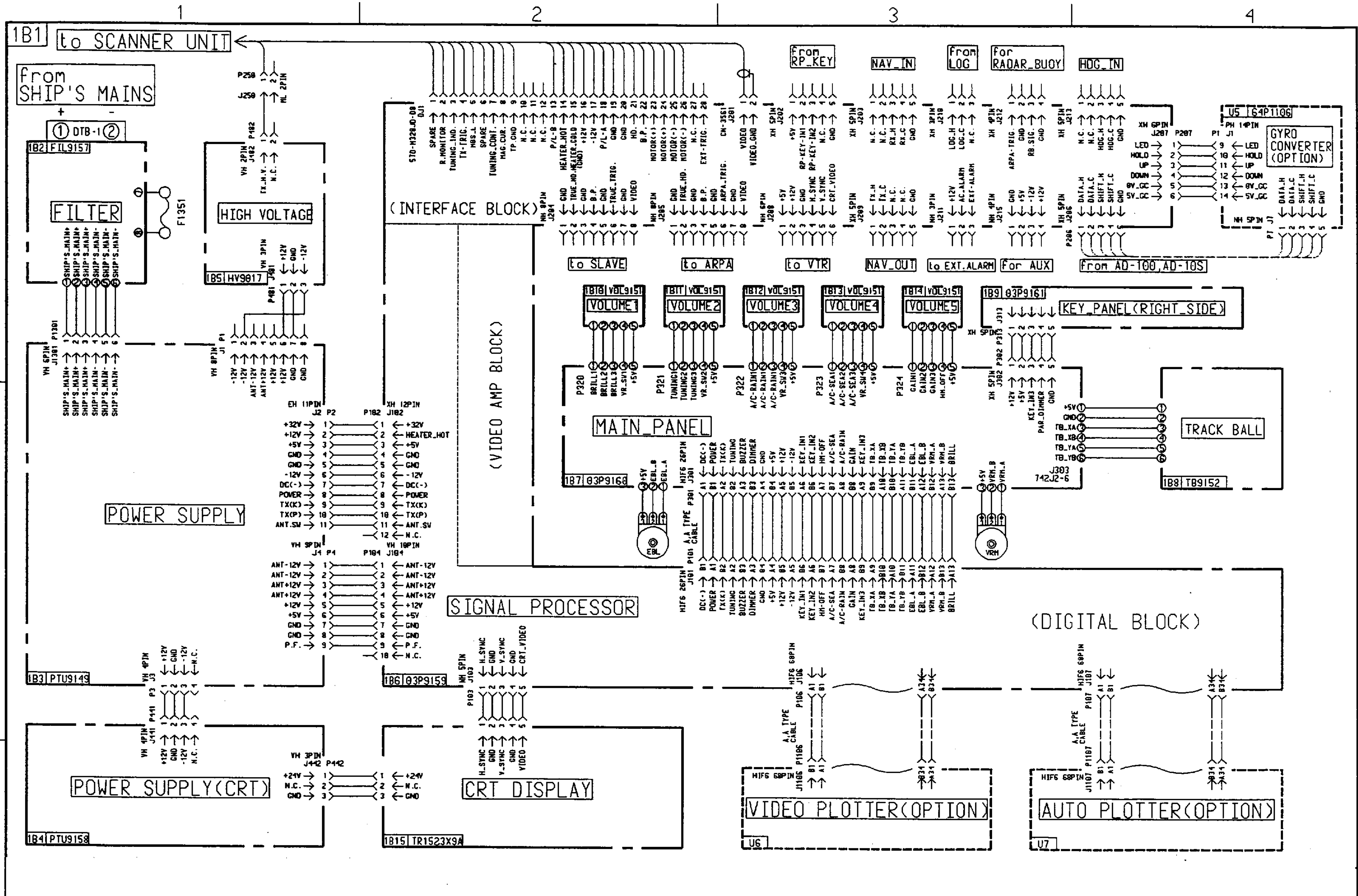
承認 APPROVED	MAY. 25. '79	三角法 THIRD ANGLE PROJECTION	名称 TITLE 空中線部組立図 SCANNER UNIT ASSEMBLING (XN3A/XN4A)
検図 CHECKED	MAY. 25. '79	尺度 SCALE	
製図 DRAWN	25. 5. 79	重量 WEIGHT kg	図番 DWG. NO. C3249-017-H



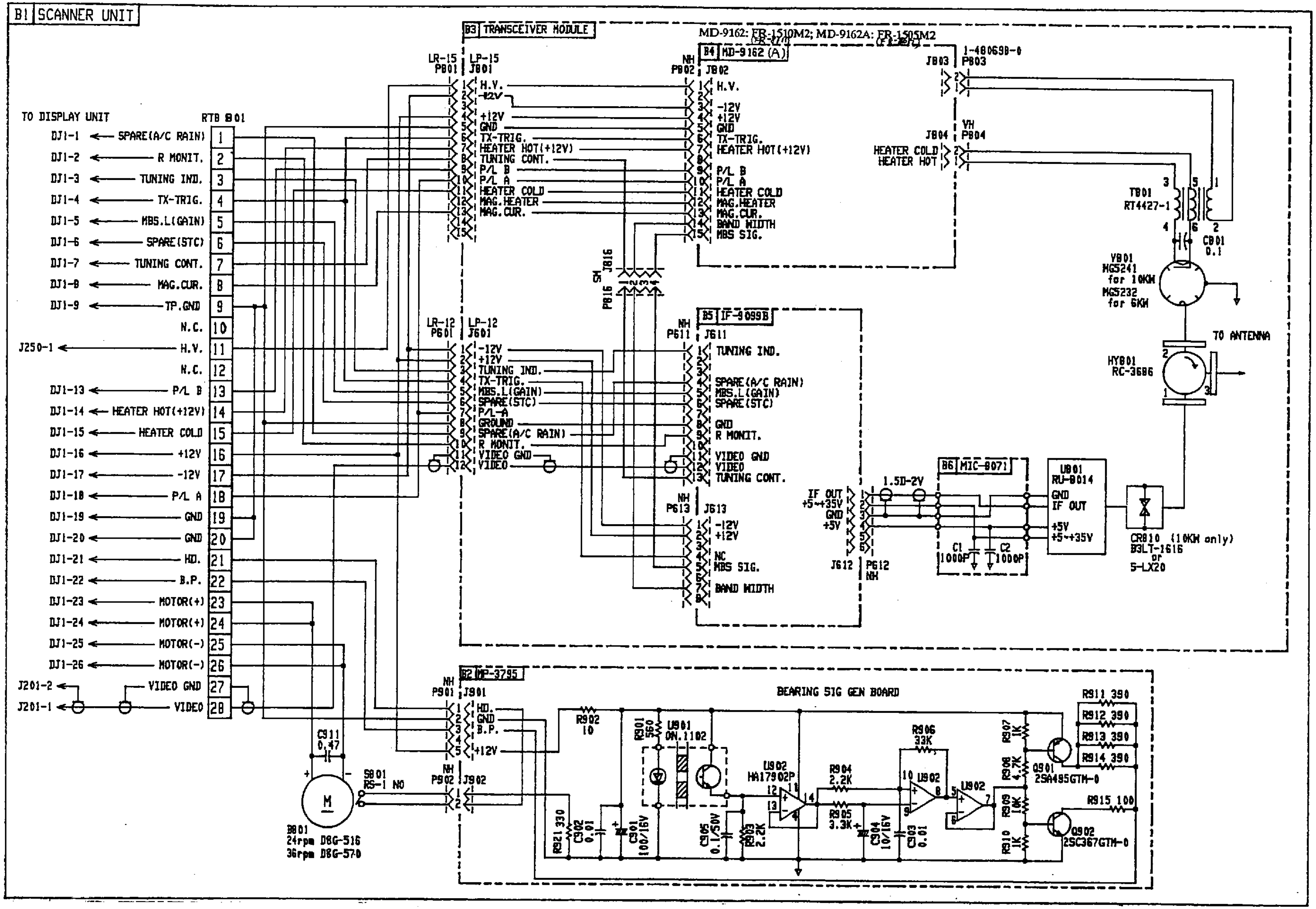
NOTE:
1. カラーコードで（ ）は内側シールド内の線を示す。
WIRE COLOR CODE( ):INSIDE B-BIG WIRE, L-RIGHT COLOR.
2. シールドは両ユニット側で完全にアースすること。
SHIELD SHOULD BE EFECTIVELY GROUNDED AT BOTH UNIT ENDS.
3. コネクタプラグ取付済。
CONNECTOR PLUG FACTORY-WIRED.
4. ＊：造船所支給
＊：SHIPYARD SUPPLY.
5. FR-1525 MARK-2の場合ＤＣ１２Ｖ電源は使用しない。
DO NOT USE 12VDC MAINS FOR FR-1525 MARK-2.

REMARKS		TYPE	FR-1505/1510/1525-M2
DRAWN K.M	APPROVED SEPT 27 '96 IKEDA	名称	相互結線図
		NAME	INTERCONNECTION DIAGRAM
SCALE	MASS kg	APPLICABLE TO: (MODEL) FR1525M2 FR1510M2 FR1505M2	BLOCK NO.
		DWG NO.	C3398-C01-C

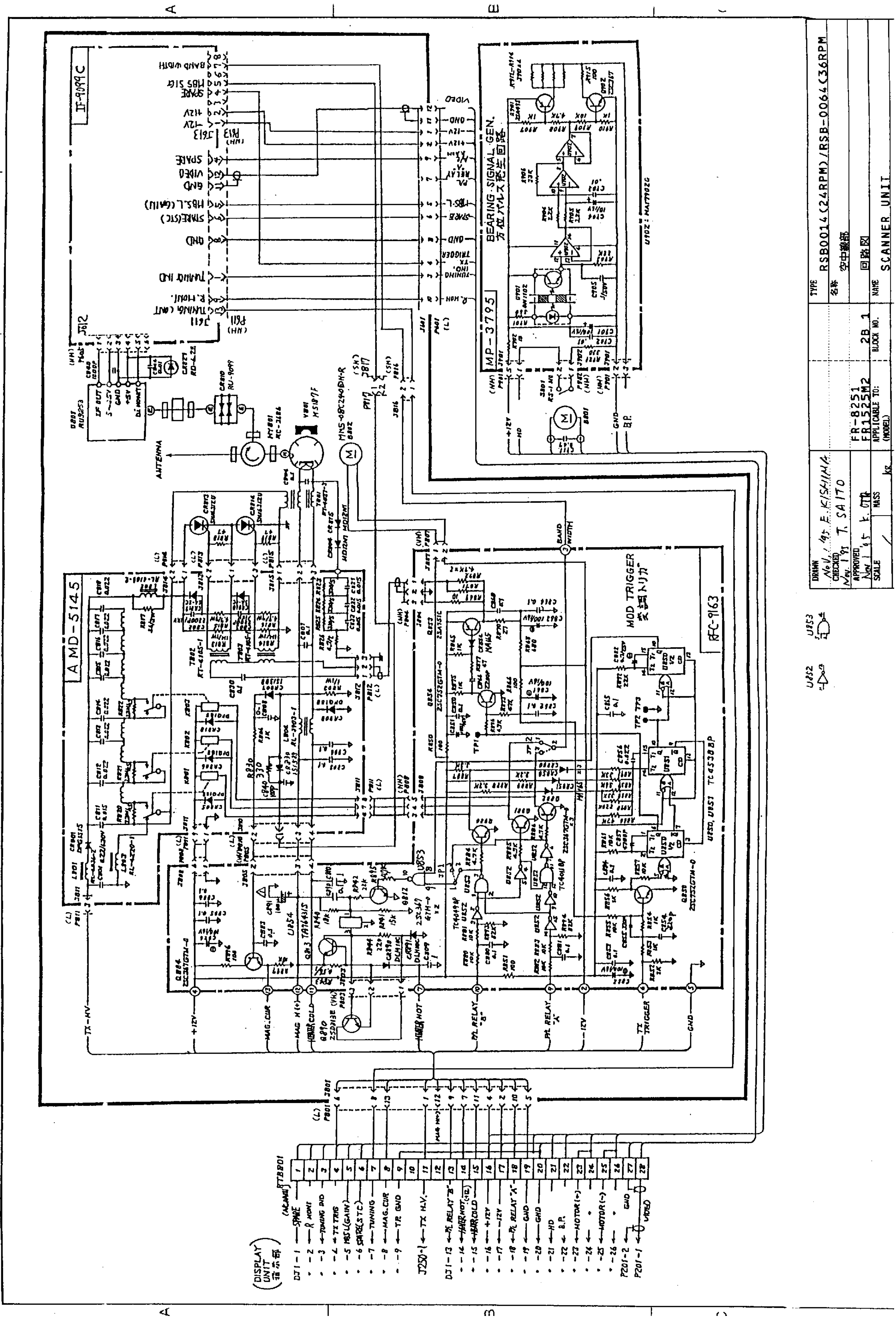
FURUNO ELECTRIC CO., LTD.



REMARKS				
DRAWN K.M	APPROVED	FR1525M2 / FR1510M2 / FR1505M2	1B 1 / 1B 1 / 1B 1	TYPE RDP-111
				名称 指示部 総合
				NAME DISPLAY UNIT, GENERAL
SCALE	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	DWG NO. C3398-K02 A



DRAWN Nov. 1 '95 E. KISHIMA	FR-8051		TYPE	C2P7N2N(24RPM)/RSB-0063(36RPM)
CHECKED Nov. 1 '95 T. SAITO	FR-8111		名称	空中線部
APPROVED Nov. 1 '95 K. OTA	FR1510M2 / FR1505M2	2B 1 / 2B 1		回路図
SCALE / MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME	SCANNER UNIT
DWG NO. C3398-K01- C				SCHEMATIC DIAGRAM


RSB0014(24RPM)/RSB-0064(36RPM)
空中線部
回路図
SCANNER UNIT
FR-8251
FR1525MK2
2B 1
E. KISHIMA
T. SAITO
AMD-5145
MP-3795
BEARING-SIGNAL GEN.
MOD TRIGGER
RFC-9163
IF-9099C
DISPLAY UNIT
RTB801